DOCUMENT RESUME

ED 344 772 SE 052 798

AUTHOR	Middleton, James A.; And Others
TITLE	Mathematics Teachers' Views about Teaching as a Profession: Final Results of a Four-Year Longitudinal Study. A Report from the Urban Mathematics Collaborative Documentation Project. Program Report 91-4.
INSTITUTION	Wisconsin Center for Education Research, Madison.
SPONS AGENCY	Ford Foundation, New York, N.Y.
PUB DATE	Dec 91
NOTE	185p.
PUB TYPE	Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01/PC08 Plus Postage.
DESCRIPTORS	Elementary Secondary Education; Interviews; Job Satisfaction; *Longitudinal Studies; *Mathematics Education; *Mathematics Teachers; Professional Autonomy; Professional Recognition; Public Opinion; Public Support; Quality of Working Life; Surveys; *Teacher Attitudes
IDENTIFIERS	*Mathematics Education Research

ABSTRACT

This paper reports the results of a 4-year longitudinal study of approximately 600 urban mathematics teachers who were surveyed to ascertain their attitudes regarding certain attributes of the profession of mathematics teaching, specifically: the use of the professional organization as a major referent, the belief in service to the public, the belief in self-regulation, a sense of calling to the field, and autonomy. The teachers were situated in 11 urban centers in the United States participating in the Ford Foundation Urban Mathematics Collaborative (UMC) project. In addition to the survey data, a written interview administered to a subset of 40 teachers was used to validate findings from the survey and to emphasize the complexity and diversity of teachers' beliefs. Included in this document are: (1) extensive discussions of the teachers' responses to the 1990 administration of the Survey of Teacher Professionalism with comparisons to the previously published results from the 1986 administration; (2) statistical analyses of the change in responses to the survey over time for those teachers who completed both surveys; (3) discussion of the response patterns to the five attributes annotated above in terms of the attribute (factor) structures generated by overall response, participation level, and collaborative site, respectively; (4) a complete listing of responses to the written interview from the subset of 40 teachers; and (5) the survey, itself. Responses, in general, indicate that teachers hold attitudes one would ascribe to members of a profession. Yet, the findings indicate that in contrast to their ideals, teachers preferred that the reality of teaching is hardly facilitative of professional development. Specifically, they tend to feel that too much control is exercised over their work by administrators and that the contribution mathematics teachers make to society is not recognized, generally. Detailed responses to the survey are included in the appendix. (JJK)

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December 1991

Program Report 91-4

Mathematics Teachers' Views About Teaching as a Profession: Final Results of a Four-Year Longitudinal Study

Report from the UMC Documentation Project

by James A. Middleton, Allan J. Pitman,
Norman L. Webb, Thomas A. Romberg,
and Susan D. Pittelman

SE 052798

Wisconsin Center for Education Research
School of Education, University of Wisconsin–Madison

MATHEMATICS TEACHERS'VIEWS ABOUT TEACHING AS A PROFESSION
FINAL RESULTS OF A FOUR-YEAR LONGITUDINAL STUDY

James A. Middleton, Allan J. Pitman, Norman L. Webb, Thomas A. Romberg, and Susan D. Pittelman

A Report from
The Urban Mathematics Collaborative Documentation Project

Wisconsin Center for Education Research
School of Education
University of Wisconsin-Madison
December 1991

We gratefully acknowledge the assistance of Margaret Powell, Kay Schultz, Donna Mlsna, Jeanne Connors, and Edel Reilly in the preparation of this report.

The research reported in this paper was supported by the Ford Foundation and by the Wisconsin Center for Education Research, School of Education, University of Wisconsin-Madison. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Ford Foundation or the Wisconsin Center for Education Research.

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ABSTRACT

This paper reports the results of a four-year longitudinal study of urban mathematics teachers. Six hundred fifty-four teachers were surveyed to ascertain their attitudes regarding the profession of mathematics teaching: the use of the professional organization as a major referent; the belief in service to the public; the belief in self-regulation; a sense of calling to the field; and autonomy. The teachers were situated in eleven urban centers in the United States participating in the Ford Foundation Urban Mathematics Collaborative (UMC) project. In addition to the survey data, a written interview administered to a subset of 40 teachers was used to validate findings from the survey and to emphasize the complexity and diversity of teachers' beliefs. Teachers responses to the survey are contrasted with responses to an earlier version of the survey administered in 1986.

Responses, in general, indicate that teachers hold attitudes one would ascribe to a profession. They regard professional organizations as fundamental to the development of their profession, and for implementing reform. They believe that their profession provides an indispensable service to society. They believe that teachers should have some responsibility for regulating their profession, yet they also believe that educators from universities and school administration should be part of a collaborative, team evaluation effort. They feel a strong sense of calling, but not to the extent that they would continue teaching if their salaries were reduced. And, while teachers believe they have autonomy within their classrooms, they also believe they should have more autonomy in making curricular decisions. In contrast to their ideals, teachers also preferred that the reality of teaching is hardly facilitative of professional development. They feel that too much control is exercised over their work by administrators and that the contribution mathematics teachers make to society is not recognized.

In addition, teachers' responses were analyzed with respect to their participation level in collaborative activities. In general, the greater their involvement in the collaboratives, the higher teachers rated items on the Survey of Teacher Professionalism. These data provide some evidence of the impact of the UMC project on teachers' beliefs and practices. However, scores for all groups of teachers increased, in general, between the 1986 and 1990 administrations of the Survey, perhaps due to the general pervasiveness of educational reform efforts. Thus, these results are difficult to separate from the larger educational movement with respect to determining cause and effect. Suffice to say that the collaboratives have forged a niche within local educational systems where teachers find professional support and enhancement.

Teachers did tend to ascribe change in their professional attitudes to the influence of the local collaboratives. Teachers believed strongly that collaboratives enhanced their professional lives as mathematics teachers. Even those who had never participated in collaborative activities were aware of the positive influence of the UMC project.

The results of this survey are discussed in relation to the conflict between teachers' professional attitudes and the lack of recognition and autonomy they receive as part of their occupational structure, and how collaboration serves to reduce this conflict.

I. INTRODUCTION

The Need for Teacher Involvement in Reform Efforts

In the early 1980s, the Ford Foundation initiated a series of programs that focused on reducing urban poverty by targeting culturally and societally important urban institutions as vehicles for instituting change. Schools in urban settings were chosen as one of the basic institutions through which effective long-term change could take place. It was felt that providing urban students with a better education would increase their potential to obtain higher paying jobs, thus bolstering personal income as well as the urban economy.

At the same time, national reports by the government, academic organizations, and private foundations argued that education in the United States had not been successful in providing *all* students with the skills, concepts, and attitudes requisite for personal growth and advancement and for maintaining the role of the United States as an international leader in business, industry, science, and technology. School mathematics was the focus of much of this criticism (Romberg, 1984).

The Second International Mathematics Study (SIMS), for example, raised concern about the effectiveness of mathematics education in the United States as compared to mathematics programs in other countries (Crosswhite, Dossey, Swafford, McKnight, & Cooney, 1985). Results indicated that, based on international standards, mathematics students in the United States did not perform well. Compared to students in other countries, eighth-grade students in the United States demonstrated only average proficiency in mathematics. In addition, United States twelfth graders who were enrolled in regular college preparatory precalculus courses scored only at the 25th percentile when compared to the international sample. The study concluded that in the United States, mathematics is taught in a "fragmented" fashion--topics are treated without any attempt to integrate them into a cohesive, unified framework. The SIMS study further concluded that many mathematics programs in the United States were "low intensity," not preparing students adequately for further study.

As a result, both the public and the government raised concern over the quality of the teachers responsible for transmitting mathematical knowledge to the nation's students. (See, for example, National Commission on Excellence in Education, 1983, *A Nation at Risk: The Imperative for Educational Reform.*) It seemed natural to assume that if students were not learning the mathematics, then teachers were not teaching the mathematics, either because they were ill-prepared, or because the conditions under which they were teaching precluded effective instruction. Some evidence suggested that both situations existed. For example, reports indicated that the majority of secondary school mathematics teachers in the United States did not meet current professional standards (National Research Council, 1989) and that over 15 percent of all teachers in the United States were teaching courses for which they were not certified (Urbanski, 1987).

In addition, numerous reports suggested that the conditions of schooling in urban areas were ill-suited for actual instruction (Carnegie Foundation, 1988; Urbanski, 1987). Greater centralization of power within urban districts, a higher percentage of students with learning problems and language difficulties, and lack of funding contributed to disenchantment and diminished enthusiasm for teaching (Frymier, 1987).

Consequently, throughout the 1980s, the federal government as well as individual states initiated large-scale education packages designed to increase the academic knowledge and professionalism of teachers (Firestone, Fuhrman, & Kirst, 1990). The most widely mandated course of action was to increase the number of academic courses and upgrade certification requirements for preservice education. The Holmes Group (1986), for example, emphasized the need for teachers of all disciplines to be thoroughly grounded in their subject matter in order to provide an adequate articulation of knowledge. They recommended that only college graduates with outstanding records in their subject areas be acceptable as teachers.

Noblit (1986) expressed concern that such national and state approaches to teacher professionalism were not merely ineffective, but served to further the deterioration of professionalism because they were based on a lack of differentiation of district needs and ignored the importance of the individual teacher as a primary factor in learning; they also ignored the role of the bureaucratic infrastructure vis a vis the implementation of change which obfuscated and undermined mandated policy. Noblit suggested that teacher-led local programs would better facilitate the development of teacher professionalism. It became increasingly clear that "top-down" programs were ineffective unless they were embraced by educators at least at the district level.

Indeed, district-level initiatives met with much less resistance. In districts in which policy focused on the needs of the students, teachers, and administrators, academic standards often exceeded the requirements mandated by the state. In addition, school-based management programs led to innovative teaching practices and increased cooperation between district administration and local teachers' organizations. Clearly, addressing the need for reform of the educational system at the teacher level was more complicated, yet was also more effective, than attempts to do so at state and national levels.

The Urban Mathematics Collaborative Project

In response to such concerns, in 1984 the Ford Foundation established the Urban Mathematics Collaborative (UMC) project to identify new models for meeting the professional needs of high school mathematics teachers. The Foundation believed that by exposing teachers to new trends in the field of mathematics and by fostering a sense of collegiality with mathematicians in the business and academic sector as well as with other mathematics teachers, local groups of mathematics teachers could work together to reform urban mathematics education from the "bottom-up." In essence, the Ford Foundation was interested in initiating a "grassroots" campaign.

The Ford Foundation's decision to concentrate on the discipline of mathematics rather than on other subjects was based on the belief that, due to the increasingly technological and empirical nature of the world economy, there was a certain urgency in preparing American students adequately for an active role in the information age.

Underlying the purpose of the UMC project is the assumption that *teachers* are the key to educational reform, advancement, and quality. With the support of the human and financial resources of the Ford Foundation, it was envisioned that local organizations of mathematics teachers in selected urban sites across the United States could reduce teachers' feelings of isolation, engender a renewed sense of teacher professionalism and enthusiasm, and ultimately encourage innovative teaching practices, such that mathematics education in these sites would be qualitatively improved (Ford Foundation, 1987; Middleton, Webb, Romberg, Pittelman, Pitman, Richgels, & Fadell, 1989).

In 1984, collaboratives were initiated in five urban centers: Cleveland, Minneapolis/St. Paul, Los Angeles, Philadelphia, and San Francisco. Within 18 months of the conception of the project, 6 more sites were added--Durham, Pittsburgh, San Diego, St. Louis, Memphis, and New Orleans--making a total of 11 Urban Mathematics Collaboratives. Between August 1989 and April 1991, four more were added--Dayton, Ohio; Columbus, Georgia; Milwaukee, Wisconsin; and Worcester, Massachusetts. Each site is autonomous, yet exists within the support network of the entire project. Each has the responsibility for garnering support (both financial and human) from local sources so that, eventually, each site will be self-sustaining.

At the time the project was instituted, the Ford Foundation established a Documentation Project at the University of Wisconsin-Madison to chronicle the progress of individual collaboratives and each collaborative's efforts in fulfilling the goals of the project. The Documentation Project was designed to gather information from sites for a period of six years (1985 through 1990) until all of the sites had the potential to evolve into a permanent structure. The Education Development Center, Inc. (EDC), a non-profit research and development organization located in Newton, Massachusetts, was engaged by the Ford Foundation to provide technical assistance to the collaboratives, to disseminate information about the UMC project, and to facilitate expansion of the collaborative concept to other sites. The Documentation Project and both the Technical Assistance Project (TAP) and the Outreach Project, which were located at EDC, link the 11 collaboratives by sharing ideas and individual successes among sites and by providing an informational network for collaborative members to use in communicating with participants at other sites.

This research report is one in a series of reports designed to provide comprehensive information on the UMC project.

Aspects and Definitions of Teacher Professionalism

Although many influences and variables help mold the teacher into a professional, two major factors delineate a profession: 1) The characteristics and structures unique to a professional occupation, including formal education, job requirements, competency measures, and evaluation; and 2) the attitudes and motivations that distinguish the professional from the lay person, including a sense of calling to the field, and the sense of belonging to an elite group of individuals (Hall, 1968). A third factor denoting whether an *occupation* is perceived to be a *profession* is the social standing the members enjoy in society at large. This external "status" sets the profession apart from the general public, and acknowledges the unique contribution that members of the profession make to society.

Because the structural aspects that make up a profession are relatively fixed--i.e., educational requirements and job descriptions are often mandated by the professional society or by convention--they are legislatable. Thus, efforts to reform the profession of teaching have most often focused on upgrading certification requirements, demanding "accountability," or prescribing new, highly structured curricula. Often neglected are attempts to influence the attitudes and motivations of teachers. Indeed, mandating "professionalism" seems to be an effective way of undermining professional attitudes, especially since such mandates more often than not come from outside the profession of classroom teaching.

Darling-Hammond (1987) posits that the current inflexible, over-regulated curriculum has contributed significantly to the lack of teacher professionalism in our country's schools. When practice is severely limited to a prescribed sequence of activities, teachers who want to attend to the individual needs of their students are inhibited because they may be going against the mandate. The relation of teachers to their work under such circumstances seems to be closer to that of a factory foreman rather than that of a professional (Pitman, 1987). Darling-Hammond suggests that teachers be given the knowledge and training to become professional troubleshooters, applying their knowledge and skills appropriately in diverse teaching situations.

To understand the development of teachers into professionals, it is necessary to examine their attitudes and motivations regarding teaching, as well as their influence on and interaction with subject matter knowledge and pedagogical knowledge.

Hall's Definition of Professionalism

"Professionalism" is often used to describe the "quality of practice . . . the manner of conduct within an occupation, how members integrate their obligations with their knowledge and skill in both a context of collegiality and their contractual and ethical relations with clients" (Sockett, 1989). Such a definition assumes that professionalism is not a state. Rather, professionalism is an aspiration, a desire to acquire and apply knowledge and skills in more efficient, or meaningful ways, and to share new knowledge with others in the profession.

Hall (1968, p. 93) identified five attitudinal attributes of professional occupations that distinguish them from trades or crafts:

1. *The use of the professional organization as a major reference*--This involves both a formal organization and informal colleague groupings as a major source of ideas and judgements for the professional in his [or her] work.
2. *A belief in service to the public*--This component includes the idea of indispensability of the profession and the view that the work performed benefits both the public and the practitioner.
3. *Belief in self-regulation*--This involves the belief that the person best qualified to judge the work of a professional is a fellow professional, and the view that such a practice is desirable and practical. It is a belief in colleague control.
4. *A sense of calling to the field*--This reflects the dedication of the professional to his [or her] work and the feeling that he [or she] would probably want to do the work even if fewer extrinsic rewards were available.
5. *Autonomy*--This involves the feeling that the practitioner ought to be able to make his [or her] own decisions without external pressures from clients, those who are not members of his profession, or from his employing organization.

There is a question whether teaching fulfills these five attributes. Teachers are afforded none of the "perks" of professional status: Societal recognition, managerial and secretarial support, and autonomy, not to mention a professional's salary. However, teachers are still held to professional standards of accountability over the quality of their product: student learning. In fact, it seems that mathematics teaching is characterized by all of the structural components of a profession, including certification, tenure, and knowledge specialization, but that few of the attitudinal components listed above apply. Herbst (1989) suggests that, based on sociological criteria of professionalism--training comparable to doctors, lawyers, or other recognized professionals; autonomy in the workplace; self-guidance through a code of ethics; peer instead of supervisor evaluation; and immediate responsibility to "clients" and ultimate responsibility to the public--the only true "professionals" in public education are administrators and specialists.

Wise (1986) feels that one factor that is a primary contributor to the lack of public perception of the teacher as a professional is the apparent lack of quality control. In the public eye, the education community has not fulfilled its obligation to produce knowledgeable students. Thus, it is concluded that teachers are not "doing their job," and are therefore not competent enough as a whole to be considered professionals.

This is often coupled with the common notion that anyone can "hang a shingle out," anyone can be a teacher:

> . . . if anyone can hang a shingle out, then no special status inheres to membership in the profession. If there is no special status, there is no reason for the public to have confidence in the profession--and no reason to pay members of the profession especially well (p. 38).

Wise suggests that one step towards the development of truly professional teachers is to require a master's degree in education for prospective teachers. He feels that teachers with a master's degree will not be less educated than many of their students' parents; at the high school level, it will also ensure that all teachers are exposed to the subject matter they teach, and that they will know at least as much as other college graduates with a major in that field; and it will provide easier access to a career in teaching for professionals from other fields who do not have a baccalaureate degree in education. In addition, he suggests that teachers pass a test of pedagogical and professional knowledge, and satisfactorily complete a yearlong internship before taking a final test to become a teacher (Wise, 1990). Wise feels that such a regimen will improve the public's image of teaching as a profession, thus putting the teacher education degree on a par with other professional degrees (an MBA, for example).

Bishop and Nickson (1983) suggest three avenues by which teachers can increase their sense of professionalism: 1) continued training in mathematics and mathematics education; 2) involvement in cooperative curriculum development programs; and 3) participation in research projects designed to improve mathematics teaching. All of these paths involve collaboration with other mathematicians and teaching professionals.

Lam (1982, 1983a, b) reports that peer relationship was the most important contributor to the professionalism of Manitoba teachers who were tested on Hall's (1968, 1969) instrument. Lam states that "peer relationships" (meaning amiable and productive interaction) was the predominant factor in determining teachers' belief in public service, their belief in self-regulation, their sense of calling, and their perceived autonomy. These results suggest that collaborative efforts that promote teachers' professional relationships through opportunities for teachers to interact with their peers in education, and in the business and university sectors should influence teacher professionalism in a positive direction.

The eleven collaboratives addressed these issues of increasing teacher professionalism in three ways: First, by increasing the knowledge and skill level of collaborative members by encouraging continued training and collaboration with mathematicians from business and university; second, by increasing teachers' sense of control and enthusiasm for their work by providing a network of communication among teachers and support for individual projects; and third, by enabling teachers to focus on the needs and conditions of teaching unique to their individual districts by creating autonomous collaboratives within each project site. In other words, an attempt was made to establish professional relationships both within and outside the profession of teaching and to focus these relationships on a common theme: improving mathematics education in urban schools.

An adaptation of Noblit's (1986) criteria of a successful corporation can be applied to the approaches the Urban Mathematics Collaboratives are taking to enhance teacher professionalism:

1) **Action**: If a teacher needs something, other teachers will help him or her obtain it.
2) **"Nichemanship"**: Teachers are members of the community, and thus better understand the needs of their students and the public in general.
3) **Autonomy and entrepreneurship**: Communication between teachers facilitates cooperation and competition among ideas and programs; it also facilitates argument aimed at the refinement of ideas.
4) **Productivity**: Respect for the individual's role leads to increased motivation to produce.
5) **Hands-on, value-driven accomplishment**: Teachers do what they believe. If they believe in the collaborative, they will participate willingly.
6) **Flexibility**: By working in a local context, local concerns and revelations can be attended to immediately without having to appeal to a higher bureaucratic structure.
7) **Networking**: Small work groups experiment and cooperate within the guiding values and themes of the collaborative.

It seems reasonable to assume that if the purpose of establishing and maintaining local organizations of mathematics teachers in collaboration with other professionals is fulfilled, then teachers' sense of their own and others' professionalism should be enhanced. The purpose of this technical report, then, is to describe the attitudes of teachers in the UMC project--those who participate frequently, those who participate occasionally, and those who have never participated in collaborative activities--as these changed over time in order to determine the impact of collaboration on their feelings of professionalism. The results of the present study will be compared to the results of an earlier study performed by the Documentation Project (Romberg, Pitman, Pittelman, Webb, Fadell, & Middleton, 1988), in order to understand how and to what extent the project has impacted on teachers' professional lives. The study focuses on teachers in the eleven Urban Mathematics Collaboratives established in 1985 and 1986.

II. METHOD

Instruments

The Survey of Teacher Professionalism

The survey used to measure teachers' beliefs about their profession was constructed by Donovan and Romberg (1986). The survey consists of five subscales based on the five attributes of professionalism identified by Hall (1969): 1) Professional organization as a major referent, 2) Belief in public service, 3) Self-regulation, 4) Sense of calling, and 5) Autonomy. Although these five domains are not considered orthogonal, they represent a useful framework by which the views of teachers regarding the professional nature of teaching mathematics can be examined. In addition to the 43 scale items on the original survey administered in 1986, six items designed specifically to gather information regarding teachers' beliefs about the impact of the collaborative on their profession were added, so that the instrument administered in 1990 was comprised of a total of 49 items.

All items were arranged on a five-point Likert-type scale, with a rating of five corresponding to Strongly Agree and a rating of one corresponding to Strongly Disagree. Eleven items on the measure were reverse-scored, requiring a rating of 1 to indicate Strong Agreement, and a rating of 5 to indicate Strong Disagreement--that is, strong *disagreement* corresponded with a more professional attitude. Responses to these items were recoded (1=5, 2=4, 4=2, 5=1) so they could be summed with other items to produce scale scores. Thus, throughout this report, a score of 5 on *any* item will indicate a positive disposition to a "professional" view. The reverse-scored items will be denoted with a superscript a (^{a}) throughout the rest of this document.

After adjusting for reverse-scored items, mean ratings were computed across items within each subscale, generating a measure of teachers' overall attitudes regarding each domain. A copy of the 49-item Survey of Teacher Professionalism appears in Appendix A. For a more detailed description of the design and piloting of the survey, refer to Romberg et al. (1988).

Previous administrations of the instrument indicate that items have moderately high internal consistency within each subscale and that all items correlate significantly with the total score obtained by summing across subscales (Romberg et al., 1988). For the present sample, the reliabilities as measured by Cronbachs' alpha ranged from .39 for the Sense of Calling subscale to .67 for the Professional Organization subscale. The overall reliability of the survey was moderately high (alpha = .77), higher, in general, than the 1986 administration.

The Diary of Professional Relationships

The Diary of Professional Relationships (Romberg et al., 1988; Middleton, Webb, Romberg, & Pittelman, 1990) is an ongoing data collection procedure designed to gather more personalized and direct information from a subset of teachers within each of the eleven UMC sites. The Diary of Professional Relationships is comprised of interview forms, each consisting of a series of four to six questions related to ongoing Documentation Project research. The information generated from the Diary is used to validate findings from group data and to emphasize the complexity and diversity of teachers' beliefs. A listing of the interview questions from the Diary of Professional Relationships can be found in *The UMC Guide to Documentation* (Pittelman, Webb, Fadell, Romberg, Pitman, & Sapienza, 1991).

In the fall of 1990, the Diary was administered to gather information on teachers' beliefs about teaching as a profession. The project representative (on-site observer) at each site was instructed to interview five teachers regarding their beliefs about the nature of mathematics teaching as a profession. The questions were:

1. a. What role do mathematics organizations play in improving mathematics instruction?
   b What role should they play?
   c. Are you a member of any professional organizations? (Please list)

2. a. What impact should mathematics teachers have on determining the basic content that is taught in their mathematics courses?
   b. What impact do the mathematics teachers in your school have?

3. a. What role should mathematics teachers play in the evaluation of mathematics teachers?
    b. What role do the mathematics teachers in your school play in regard to the evaluation of other mathematics teachers?

4. Do you think of yourself primarily as a teacher or as a mathematician? Why?

5. What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?

6. How has the collaborative enhanced your view of yourself as a professional?

To ensure that teachers felt comfortable answering truthfully, responses on the Diary of Professional Relationships were anonymous. Thus, although teachers' participation levels and whether they completed the Survey of Teacher Professionalism were recorded, it was not possible to match teachers' responses on the Diary with their responses on the Survey. The responses to Diary of Professional Relationships questions, obtained from 55 teachers from the 11 collaboratives, are presented in Appendix B.

Participants

Three groups of teachers were targeted by the Documentation Project for the present study. The first group was comprised of teachers who had responded to the 1986 administration of the Survey of Teacher Professionalism (Romberg et al., 1988) in an attempt to ascertain how their beliefs had changed, if at all, due to their participation in the UMC project. The second group consisted of teachers who had provided the Documentation Project with information in the past regarding their conceptions of mathematics and mathematics education (Middleton, Webb, Romberg, & Pittelman, 1990), and their prior education and background (Middleton, Webb, Romberg, Pittelman, Pitman, Richgels, & Fadell, 1989). The final group of teachers targeted were those who, although they lived in a UMC site, had never participated in collaborative activities. These teachers' beliefs were elicited in an effort to contrast their beliefs with those of collaborative teachers. In responding to the survey, teachers were asked to classify themselves based on their level of participation in the collaborative: Frequent, Occasional, or Never participating. One hundred surveys were distributed to the project coordinator or on-site observer in each of the eleven collaborative sites. The total number of respondents (654) represents an overall return rate of 59 percent. The breakdown of returned surveys by participation level for each collaborative site is presented in Table 1.

Table 1

Number of Returned Surveys by Collaborative Participation Level (1990 Administration)

	Participation Level		
Collaborative	Frequent	Occasional	Never
Cleveland	49	47	5
Durham	17	17	3
Los Angeles	32	36	9
Memphis	34	15	3
New Orleans	24	17	2
Philadelphia	17	29	4
Pittsburgh	34	54	0
St. Louis	18	32	0
San Diego	12	26	0
San Francisco	20	13	1
Twin Cities	27	33	7
Total	284	320	34

*Note: Sixteen teachers did not indicate their participation level

III. RESULTS

The methodology used to record teachers' beliefs about their profession enables us to provide information regarding the impact of the UMC project in three ways. First, with the information from two relatively large cross-sections of collaborative participants taken at two points in time, we can examine whether there is a gross change in attitude from 1986 to 1990. Second, on the basis of information broken down by the respondents' level of participation in collaborative activities, we can examine attitudinal differences between frequent participants (Frequent), occasional participants (Occasional), and those who have never participated (Never) as a function of time. Third, information from individuals who completed both Surveys of Teacher Professionalism will enable us to analyze more subtle, individual differences in attitude as the UMC project matured.

For purposes of clarity, this chapter will be organized into two sections; the first describes teachers' responses to the 1990 administration of the Survey of Teacher Professionalism, and compares these results with the previously published results of the 1986 administration. The second section is devoted to an analysis of the change in responses to the Survey over time from those teachers who completed both Surveys. Responses to items are organized by the five attributes of professionalism outlined by Hall (1969): Professional Organization as a Major Referent; Belief in Public Service; Importance of Self-Regulation; Importance of Sense of Calling; and Autonomy. Items characterizing each attribute will be analyzed by overall response, by participation level, and by collaborative site. In addition, responses to the Diary of Professional Relationships will be used to highlight important patterns in teachers' reactions to the Survey (see Appendix B for a complete listing of teachers' responses). Following this analysis is a brief discussion of the significance of the point at which teachers become involved in the project: Early vs. Late participation. And, finally, an examination of the factor structure of the two surveys is presented.

Caution must be taken in interpreting the results of the reported analyses. Due to the large number of contrasts, especially in the analysis of individual items, it is highly likely that some Type I errors (errors in which we conclude falsely that differences do exist between different groups) will be reported. Thus, in forming conclusions, one must look at the overall pattern of responses, rather than at differences on specific items. By focusing on the general patterns of responses, consistencies in teachers' professional attitudes should become evident.

Teachers' Responses to the 1990 Administration of the Survey of Teacher Professionalism

To aid the reader in drawing comparisons between the 1986 and 1990 administrations of the Survey of Teacher Professionalism, this section is organized similarly to the report of the original administration (Romberg et al., 1988). Each subscale will be examined in detail, separately. First, descriptive statistics pertaining to each item making up each subscale will be presented for the entire sample. Next, the mean (scale) score for each subscale will be compared across collaborative sites. Lastly, responses to items will be analyzed by teachers' collaborative participation level.

Professional Organization as a Major Referent

The use of the professional organization as the primary professional referent by the teacher involves two facets. One is a sense of collegiality with other members of the mathematics and mathematics education communities. The other is a belief that the professional organization provides intellectual, social, and advocacy support for efforts to reform mathematics education (Romberg et al., 1988). Thus the professional organization becomes the major source of ideas and interpretation for the teacher in her/his work (see Hall, 1969).

On those items on the Professional Organization Scale that addressed teachers' feelings of collegiality, teachers indicated that they feel fairly comfortable meeting with mathematicians from the business and university sectors, and that collaboration with these members of the mathematics community is important. (See Table 2 for means and standard deviations of these items.) These responses are highly similar to those of teachers in the 1986 administration. Although three of the four items addressing collegiality showed higher mean scores in 1990, it is unclear whether the observed differences are significant. The only item in Table 2 where teachers registered a noticeable decrease from 1986 was in Item 35. Although many teachers agreed that mathematics teachers hold their own in discussions with business and university mathematicians, the large standard deviation indicates that many also disagreed with the statement.

Table 2

Means and Standard Deviations of Items on the Professional Organization Scale: Collegiality with Mathematicians

	Item	1986 Mean	1986 *SD*	1990 Mean	1990 *SD*
1.[a]	I feel out of place meeting with mathematicians from businesses and universities.	3.841	1.000	3.962	.919
27.	Mathematics teachers feel it is important to have the opportunity to meet with business and university mathematicians on an equal level.	3.793	.883	3.877	.743
35.	Mathematics teachers hold their own in discussions with business and university mathematicians.	3.313	.891	3.262	.905
40.	Mathematics teachers feel they have an important contribution to make in discussions with business and university mathematicians.	3.616	.843	3.694	.803

[a]Reverse Item

Table 3

Means and Standard Deviations of Items on the Professional Organization Scale: Organizational Support

	Item	1986 Mean	1986 SD	1990 Mean	1990 SD
5.	Mathematics teachers regularly read journals and publications about mathematics and its applications.	2.972	.974	3.14	.969
20.	I believe that professional mathematics education organizations at the local level should play a vital role in changing school mathematics.	3.550	.855	3.756	.825
24.	Mathematics teachers believe it is important to support professional mathematics education organizations at the local level.	3.317	.924	3.541	.828
30.	I regularly attend professional meetings and dinners organized by professional mathematics education organizations at the local level.	2.937	1.099	3.33	.1133
33.[a]	I think that local professional mathematics education organizations do not do much for the average mathematics teacher.	2.960	.990	3.33	.946

[a]Reverse item

In reference to items on the Professional Organization Scale that addressed teachers' beliefs about organizational support, results indicate that UMC teachers feel that professional mathematics education organizations should lead the way for the reform of school mathematics and that it is important to support such organizations and attend professional meetings and activities. Table 3 lists the means and standard deviations of these items. These responses indicate a substantial positive change in attitudes towards organizational support since the inception of the UMC project. Indeed, teachers in the 1990 sample responded more favorably toward *all* of the items measuring organizational support than teachers in the 1986 sample. Many of these items raised from one fifth to over one third of a standard deviation. At this time, it is unclear whether this change in attitude is a direct result of collaborative influence. It may be reflective of the current movement towards mathematics education reform led by such professional organizations as the National Council of Teachers of Mathematics (NCTM) and the American Association for the Advancement of Science (AAAS). Nevertheless, there are still a substantial number of teachers in the study with negative views towards organizational support items. In particular, the means of approximately 3 (neutral rating) and the large standard deviations for Items 5, 30, and 33 indicate that many teachers do not read professional publications, do not attend professional meetings organized by professional organizations, and think that professional mathematics teachers' organizations do not do much for the average mathematics teacher. The relationship between these patterns and collaborative participation will become clearer later when we look at response differences between Frequent, Occasional, and Never participants.

When teachers' responses to items on the Professional Organization Scale are analyzed by site, results indicate considerable variation both between and within sites. Although the mean response for the Professional Organization Scale increased for all sites from 1986 to 1990, their relative positions showed little change. The sites with the four highest mean responses in 1986 (Durham, Cleveland, New Orleans, and San Francisco, in that order) were also the sites with the four highest mean responses in 1990. Further, the sites with the four lowest mean responses in 1986 (Los Angeles, San Diego, Pittsburgh, and Philadelphia, in that order) were the sites with the four lowest mean responses in 1990 (see Table 4). The Twin Cities fell in the middle both times.

Table 4

Means and Standard Deviations of the Professional Organization Scale by Collaborative Site

	1986			1990		
Collaborative	N	Mean	SD	N	Mean	SD
Cleveland	64	3.481	.516	100	3.666	.391
Durham	46	3.507	.478	37	3.700	.518
Los Angeles	45	3.163	.535	79	3.376	.496
Memphis	--	--	--	52	3.652	.473
New Orleans	105	3.479	.471	45	3.773	.465
Philadelphia	63	3.313	.539	49	3.508	.478
Pittsburgh	79	3.253	.438	90	3.336	.498
St. Louis	--	--	--	48	3.410	.430
San Diego	46	3.192	.448	38	3.521	.446
San Francisco	66	3.400	.478	35	3.651	.449
Twin Cities	62	3.396	.423	67	3.562	.455
Total	576	3.367	.490	641	3.540	.480

Table 5

Analysis of Variance: Professional Organization Scale by Collaborative Site (1990 Scale)

Source	D.F.	Sum of Squares	Mean Square	F
Between	10	12.841	1.284	6.006*
Within	629	134.467	0.214	
Total	639	147.307		

*$p < .05$

An analysis of variance (ANOVA) detected significant differences between many of the sites (see Table 5). Post-hoc Tukey HSD pairwise comparisons pinpointed the sites that showed the significant differences. Table 6 indicates that teachers in Pittsburgh, Los Angeles, and San Diego believed less in professional organizations as a major referent than teachers in San Francisco, Memphis, Cleveland, Durham, and New Orleans. This grouping may be reflective of the collaborative participation levels of the responding teachers in each site. At the Pittsburgh, Los Angeles, and San Diego sites, more teachers responded who were Occasional participants than teachers who were Frequent participants. At the Memphis, Cleveland, Durham, and New Orleans sites, more Frequent participants responded than Occasional participants.

Table 6

Post-hoc Tukey Contrasts by Collaborative Site for the Professional Organization Scale (1990 Administration)[*]

Collaborative	Mean	Pittsburgh *t*	Los Angeles *t*	San Diego *t*
Pittsburgh	3.336			
Los Angeles	3.376			
San Diego	3.410			
San Francisco	3.651	3.417		
Memphis	3.652	3.762	3.207	
Cleveland	3.666	5.041	4.256	
Durham	3.700	3.640	3.185	
New Orleans	3.773	5.026	4.462	3.903

[*]Note: All reported *t*-values are significant $p < .05$.

Teachers' responses to the Diary of Professional Relationships reflect the trend for an increase in a positive attitude toward professional mathematics education organizations. When asked "What role do mathematics organizations play in improving mathematics instruction?" teachers focused on three primary areas: 1) Mathematics education organizations assist teachers in developing new ideas and approaches to instruction; 2) They provide a forum for enacting reform at a grass roots level; and 3) Mathematics education organizations provide encouragement for teachers to study and broaden their views of mathematics. A teacher from the Memphis collaborative, for example, said, "I think math organizations are the movers and shakers of math reform. They inform teachers [on] what must be changed in order to keep up with an ever changing technological world. Math organizations give teachers a direction; they keep us up-to-date with new techniques for presenting concepts." A teacher from the Twin Cities echoed these sentiments. "I believe they [mathematics organizations] open doors for math teachers in showing new issues, new topics, new methods. However, not all math teachers choose to walk through these doors."

When asked "What role should mathematics organizations play?" teachers indicated that for the most part, they play the roles they should play--i.e., the roles presented above. In addition, however, many teachers felt that mathematics education organizations should become vehicles for advocacy of the reform effort in dealing with administrative bodies and policymakers. Moreover, many teachers were enthusiastic towards mathematics organizations, but expressed a concern that teachers often are not granted adequate funding to attend workshops and conferences sponsored by such groups. For example, a Durham teacher replied, "They [mathematics organizations] should play the role that they do, but in addition they should offer some funding; e.g., NCTM has had me do workshops at some meetings but I must pay my own expenses unless I can get a grant from some other source."

The teacher from Memphis quoted earlier volunteered her desire for advocacy. ". . . [the mathematics organizations] should be the spokesmen for math teachers and their needs. They need to lobby to get updated classrooms with modern technology to aid in math education." A San Francisco teacher qualified these sentiments with the observation that mathematics education organizations should be independent of the school bureaucracy. "[They should] get teachers involved politically having a say in the district. I mean, I think they have to be independent of bureaucracy. Influence it without becoming it."

All respondents to the Diary of Professional Relationships were asked to list the mathematics education organizations they belong to. All respondents indicated membership in at least one organization, and most were members of two or more. Their responses reflect findings reported by Middleton et al. (1989)--that is, teachers were members of several local, state, and national organizations, most of which were affiliated with the NCTM. Interestingly, most teachers did not list their local mathematics collaborative as a professional mathematics education organization. It is unclear from teachers' responses how the collaboratives are perceived and whether they are regarded as professional organizations.

Some of the variation in teachers' responses can be explained by examining their reported levels of participation in collaborative functions. Table 7 provides the means and standard deviations for the Professional Organization Scale by the three levels of collaborative participation: Frequent, Occasional, and Never. The magnitude and direction of the mean values for the three levels is as expected: Frequent collaborative participants were more attuned to their professional organization as a referent to their work than Occasional participants, and Occasional participants were more attuned than Never participants. These differences are significant $p < .05$ (see Table 8). This is strong evidence of the extent to which the level of participation in the UMC project accords with teachers' beliefs, especially when coupled with data from the 1986 survey, which display the same pattern.

While both Frequent and Occasional collaborative participants increased their use of professional organizations as a major referent, those who had never participated actually showed a *decrease* (albeit modest). This would seem to indicate that participation in a professional organization is viewed in a positive sense by mathematics teachers, and that in spite of forces that might lessen their sense of professionalism, participation in the UMC project has influenced teachers to become involved in professional activities, and to use their professional contacts in a professional manner.

Table 7

Means and Standard Deviations for the Professional Organization Scale by Collaborative Participation Level

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.542	.472	280	3.670	.476
Occasional	245	3.321	.468	313	3.441	.433
Never	172	3.270	.499	34	3.245	.474
Total	576	3.367	.490	627	3.546	.477

Table 8

Planned Holm Contrasts by Collaborative Participation Level for the Professional Organization Scale (1990 Administration)

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.259	567.2	6.908*
Frequent - Never	0.455	41.5	5.274*
Occasional - Never	0.195	39.2	2.300*
(F + O)/2 - Never	0.325	36.6	3.892*
Frequent - (O + N)/2	0.357	79.9	6.981*

*$p < .05$

To further explicate the collaboratives' impact on teachers' perceptions of the importance of professional organizations, five planned sequential comparisons (Holm, 1979) were performed for each Professional Organization item: The three possible pairwise comparisons (Frequent vs. Occasional, Frequent vs. Never, and Occasional vs. Never) and two complex comparisons focusing on the average of the collaborative participants vs. nonparticipants ($\frac{[\text{Frequent + Occasional}]}{2}$ - Never) and Frequent participants vs. the average of Occasional and nonparticipants (Frequent - $\frac{[\text{Occasional + Never}]}{2}$) were performed. This procedure was chosen to pinpoint those attitudes that distinguish between the three participation levels, and to eliminate those attitudes that are similar across levels.[1]

Results indicate that Frequent participants tend: (1) to feel more comfortable meeting with other mathematicians, (2) to regard such interaction as more important and helpful for mathematics teachers, and (3) to feel that professional mathematics education organizations should lead the way in the reform of school mathematics.

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[1] Due to the disparity in sample size across participation levels, comparisons used separate variance estimates for calculation of *t*-values. This accounts for the unequal sample size and is more conservative than a pooled estimate. The degrees of freedom used for determining the significance level of the *t* tests are weighted by the relative contribution of each participation level; thus, some are not whole numbers.

Tables 9 and 10 present the mean values and the contrasts for Item 1 (a reverse-scored item). As was expected, a direct relationship exists between participation level and feelings of comfort a teacher has with mathematicians from business and higher education. The magnitude of the mean values and their direction yield an easily interpretable pattern for Item 1: The more opportunity a teacher has to interact with mathematicians from other areas (i.e., the greater the participation in collaborative activities), the more comfortable she/he will feel in future encounters.

Table 9

Means and Standard Deviations for Item 1[a] *by Collaborative Participation Level*: I feel out of place meeting with mathematicians from businesses and universities.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	158	4.057	.946	284	4.141	.816
Occasional	247	3.814	1.023	320	3.856	.953
Never	173	3.687	1.009	34	3.500	.961
Total	578	3.843	1.007	638	3.964	.911

[a]Reverse-scored item

Table 10

Planned Holm Contrasts by Collaborative Participation Level for Item 1[a]

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.285	601.3	3.955*
Frequent - Never	0.641	38.9	3.729*
Occasional - Never	0.356	40.2	2.056*
(F + O)/2 - Never	0.499	36.2	2.954*
Frequent - (O + N)/2	0.463	68.3	4.663*

*$p < .05$

[a] Reverse-scored item

However, contrast patterns for other items are not so obvious. For example, although, as expected, Frequent participants believe that professional mathematics organizations should play a vital role in changing school mathematics (Item 20) more so than Occasional participants, no significant differences were evident between the attitudes of Frequent and Never participants (see Tables 11 and 12). In addition, Never participants showed a mean score for Item 20 that was *higher* than Occasional participants, although this difference was non-significant. It is unclear at this time what this pattern indicates in relation to the impact of the UMC project.

Table 11

Means and Standard Deviations for Item 20 by Collaborative Participation Level: I believe that professional mathematics education organizations at the local level should play a vital role in changing school mathematics.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	158	3.709	.793	283	3.926	.761
Occasional	249	3.459	.915	319	3.605	.873
Never	170	3.547	.815	34	3.882	.591
Total	577	3.553	.859	636	3.727	.826

Table 12

Planned Holm Contrasts by Collaborative Participation Level for Item 20

Contrast	Mean Difference	D.F.	t
Frequent - Occasional	0.321	599.8	4.816*
Frequent - Never	0.043	47.2	0.391
Occasional - Never	-0.277	49.8	2.464*
(F + O)/2 - Never	-0.117	40.5	1.096
Frequent - (O + N)/2	0.182	125.9	2.522*

$^*p < .05$

The pattern of responses across participation level indicates that the value teachers place on having the opportunity to meet with business and university mathematicians on an equal level (Item 27) is a direct function of collaborative participation (see Tables 13 and 14). Results for Item 27 reveal that not only do Frequent and Occasional participants in collaborative activities see meeting with business and university mathematicians as being important, their beliefs are significantly stronger than Never participants. Moreover, Frequent participants were more adamant regarding the importance of professional contacts than Occasional participants.

Table 13

Means and Standard Deviations for Item 27 by Collaborative Participation Level: Mathematics teachers feel it is important to have the opportunity to meet with business and university mathematicians on an equal level.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	4.000	.842	282	4.000	.721
Occasional	249	3.718	.901	320	3.816	.726
Never	172	3.709	.863	34	3.500	.788
Total	580	3.790	.882	636	3.881	.737

Table 14

Planned Holm Contrasts by Collaborative Participation Level for Item 27

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.184	591.5	3.121*
Frequent - Never	0.500	39.9	3.526*
Occasional - Never	0.316	39.2	2.236*
(F + O)/2 - Never	0.408	36.2	2.947*
Frequent - (O + N)/2	0.342	72.2	4.143*

*$p < .05$

Teachers' responses to Item 30, in which they indicate whether they regularly attend professional meetings, can be taken as validation of teachers' reported participation levels (see Tables 15 and 16). Frequent participants agreed fairly strongly that they regularly attend meetings and dinners organized by professional organizations, while Occasional participants were somewhat neutral regarding the regularity of their attendance, and Never participants indicated that they rarely attend professional functions put on by local professional mathematics education organizations.

It must be noted that this pattern of responses to Item 30 would suggest that the local collaboratives are a primary, if not the only local mathematics education organization attended by many of the participating mathematics teachers (see Middleton et al., 1989, for a breakdown of the number of collaborative participants who are members of a number of mathematics education organizations). The point-biserial correlation between collaborative participation level and response to Item 30 is .48, moderately high. This value signifies that to a significant extent teachers attendance at professional functions can be accounted for by their level of participation in the collaborative. Very few Frequent participants (58, or 20 percent) responded in a neutral fashion, or disagreed with this item, whereas very few Never participants *agreed* (6, or 18 percent). Occasional participants were distributed fairly evenly around neutral.

Table 15

Means and Standard Deviations for Item 30 by Collaborative Participation Level: I regularly attend professional meetings and dinners organized by professional mathematics education organizations at the local level.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.509	1.055	284	3.926	.972
Occasional	247	2.911	1.028	319	2.919	1.006
Never	172	2.448	.999	34	2.353	1.125
Total	578	2.938	1.101	637	3.338	1.134

Table 16

Planned Holm Contrasts by Collaborative Participation Level for Item 30

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	1.008	597.0	12.497^*
Frequent - Never	1.573	39.1	7.812^*
Occasional - Never	0.566	38.8	2.814^*
(F + O)/2 - Never	1.069	35.9	5.425^*
Frequent - (O + N)/2	1.290	67.6	11.136^*

$^*p < .05$

On Item 33 of the Survey, teachers indicated whether they felt local professional organizations helped the average teacher (see Tables 17 and 18). Results show that Frequent participants disagreed fairly strongly with the negatively worded Item 33, while Occasional participants disagreed only slightly. Never participants, perhaps because they do not attend professional functions at the local level and thus have little experience on which to base their attitudes, were neutral, or agreed slightly that local professional mathematics education organizations do not do much for the average teacher. In addition, the mean response was approximately one half of a standard deviation higher in 1990 than in 1986 for Frequent participants, and approximately one third of a standard deviation higher for Occasional participants, while the Never participants showed little if any change. Although these patterns were expected, there was still considerable variation among teachers' attitudes. Many Frequent participants were neutral, or agreed slightly with the negative statement, while many Never participants disagreed. Although the reasons are unclear at this time, it seems likely that local organizations affect individual teachers differently depending upon their needs and exposure to the organizations.

Table 17

Means and Standard Deviations for Item 33[a] by Collaborative Participation Level: I think that local professional mathematics education organizations do not do much for the average mathematics teacher.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.057	1.002	284	3.500	.960
Occasional	247	2.943	.990	319	3.257	.899
Never	173	2.902	.975	34	2.912	1.055
Total	579	2.962	.981	637	3.347	.947

[a]Reverse Item

Table 18

Planned Holm Contrasts by Collaborative Participation Level for Item 33[a]

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.243	581.7	3.196*
Frequent - Never	0.588	39.8	3.101*
Occasional - Never	0.345	38.3	1.838*
(F + O)/2 - Never	0.467	36.0	2.524*
Frequent - (O + N)/2	0.415	70.4	3.783*

*$p < .05$

[a]Reverse Item

Summary

The results of the Professional Organization Scale support the conclusion that collaborative participation is strongly related to participation in and valuing of professional organizations. The degree of participation in the collaboratives seems related to comfort in meeting with mathematicians from business and higher education and attendance at professional meetings. While the relationship between the degree of participation and belief that professional organizations should play a vital role in changing school mathematics is less clear, both Frequent and Never participants consistently felt stronger on this than Occasional participants. That collaboratives differed significantly in how members view professional organizations cannot be easily explained. This suggests that local conditions are relevant factors regarding a belief in professional organizations as a referent for professionalism. However, being associated with a collaborative, as shown at all sites, does relate to increasing teachers' valuation of professional organizations.

Teachers in general did not respond to items on the Professional Organization Scale as positively as they did to items on three other scales on the Survey: Self-Regulation, Sense of Calling, and Autonomy. It appears, therefore, that professional attitudes of collaborative teachers are less weighted toward professional organizations than toward the other attributes. However, the greatest change in any scale on the instrument occurred on Professional Organization. Thus, it will be interesting to see how this factor plays out as the collaboratives mature and change.

Belief in Public Service

Belief in Public Service as an attitudinal component of professionalism refers to teachers' conviction that their jobs have societal importance and that their profession is *indispensable* to society. Two conceptions guide teachers' beliefs in the efficacy of public service: Beliefs regarding the benefits of the profession of mathematics teaching to society and the recognition society gives mathematics teachers for their service.

As with their beliefs regarding the Professional Organization scale, overall, teachers were in moderate agreement with the Belief in Public Service scale. The mean response across all items in the scale was 3.521, with a standard deviation of 0.488. This rating is similar to teachers' beliefs as documented on the 1986 survey, where the mean response was 3.481, with a standard deviation of .521. This moderate belief can be partially explained in terms of the contrast between teachers' beliefs in the importance of their work against their perception of its social standing.

For example, teachers agreed *very strongly* that the teaching of mathematics is essential to society and that any weakening in its role would be detrimental to society (see Table 19). The mean scores for the three items related to Social Benefits (Items 2, 25, and 31) increased from the 1986 to the 1990 administrations of the Survey, indicating an overall positive change in teachers' attitudes. Further, the magnitude of the standard deviations of these items was smaller in 1990 than in 1986. This would indicate that not only do teachers believe more deeply in the social benefits of their work, they also are less divided in their opinions.

Table 19

Means and Standard Deviations of Items on the Belief in Public Service Scale: Belief in Social Benefits

		1986		1990	
Item		Mean	SD	Mean	SD
2.	Mathematics teachers believe in the social benefits of their work.	3.850	.897	3.963	.792
25.	I think that the teaching of mathematics is essential in our society	4.771	.445	4.810	.397
31.	Mathematics teachers believe that any weakening in the teaching of mathematics as a profession would be harmful for society.	4.181	.752	4.298	.628

In contrast, teachers' attitudes regarding the recognition they receive from others showed little if any change between 1986 and 1990 (see Table 20). In both administrations, teachers reported neutral to negative feelings regarding others' recognition of their work and their contribution to society, although there was a great deal of variation in teachers' responses. Thus, although teachers believe they are important to the well-being of society, they believe this feeling is not reciprocated by the society they are serving. In addition, these findings indicate that although the mathematics education reform movement has affected teachers' attitudes, the overall effects seem to be isolated, and as of yet, teachers feel that it has not greatly impacted on the attitudes of the general public towards mathematics education.

Table 20

Means and Standard Deviations of Items on the Public Service Scale: Recognition by Others

		1986		1990	
Item		Mean	SD	Mean	SD
10.	I think that the importance of teaching high school mathematics is widely recognized by others.	3.378	1.166	3.383	1.122
22.[a]	I believe my work as a mathematics teacher is not appreciated by most people.	2.868	1.099	2.883	1.029
28.[a]	Mathematics teachers feel that their contribution to society is not recognized by business and university mathematicians.	2.852	1.025	2.869	1.009
39.[a]	Mathematics teachers feel that the public does not realize the contribution that mathematics teachers make to society.	2.463	1.023	2.454	0.964

[a]Reverse item

When teachers' responses to the Belief in Public Service scale are analyzed by collaborative site, some interesting patterns emerge (see Table 21). Although teachers in the majority of the nine collaboratives who participated in both administrations of the Survey showed a positive increase in scores regarding their beliefs in public service, in two collaboratives there was actually a *decrease*. Teachers from Durham and San Francisco rated their Belief in Public Service, on average, lower in 1990 than in 1986. In San Francisco, this drop was small and might be considered negligible. However, teachers in the Durham collaborative dropped about one fifth of a standard deviation.

Taken in context, this finding is quite interesting. The Durham Mathematics Council struggled with the issue of organization in 1989-1990. Not as many activities were planned as in the past and teacher interaction with business and higher education representatives was limited mainly to the Board of Directors and the Triangle Mathematics Club. In addition, the Durham Mathematics Council took a different approach in raising funds from local businesses (see Webb, Pittelman, Sapienza, Romberg, Pitman, & Middleton, 1991), for a more complete description of Durham's transition into a permanent structure).

This interaction with business and higher education seems to be closely related to the rank order of sites with respect to the Public Service Scale. Two members of the Documentation Project independently ranked the collaborative sites with respect to their interaction with business and higher education (Spearman $r_{\text{between raters}} = .85$). When this rank order was compared to the rank order of sites with respect to the Public Service Scale, the Spearman correlation was .91, indicating a *very* high relationship. This finding indicates that teachers from those collaboratives that have had a more intense involvement with higher education and business have, on the average, a higher regard for their profession's public service and feel more accepted by those groups than teachers from collaboratives not as involved with these sectors. The Twin Cities and San Diego collaboratives, for example, are hosted by institutions of higher education. Cleveland, the highest ranking collaborative on the Public Service Scale, is not hosted by business or higher education, but has a strong board with active representation from these sectors, and many summer institutes in Cleveland were sponsored by business and higher education. Teachers from these collaboratives were the most positive toward Public Service.

New Orleans, also highly ranked, has had an active group of business and higher education representatives serving on its board and working with its program. The New Orleans collaborative showed the greatest positive change in attitude for items on the Belief in Public Service scale; teachers rated items on average about one third of a standard deviation higher in 1990 than in 1986. In fact, New Orleans teachers' Belief in Public Service ranked as one of the lowest in the 1986 administration and changed to one of the highest rankings in the 1990 administration. In 1989-1990, teachers in New Orleans became more politically active and internships gave teachers recognition from the business community. Individuals from higher education were actively involved in organizing programs with the collaborative.

Teachers in collaboratives that have concentrated their efforts more within the school districts than in the higher education and business communities, such as Pittsburgh, Philadelphia, and St. Louis, were less positive on Public Service Scale. This provides some indication that the approach taken to collaboration and the degree of participation of those from other sectors is related to a more positive view of their profession as service to the public. These findings, however, must be tempered by the fact that the differences between collaboratives were very slight. An analysis of variance on the 1990 data revealed non-significant differences between collaborative sites on the Belief in Public Service scale (see Table 22). When responses to the Public Service scale are analyzed by collaborative participation level, nonsignificant differences are evident (see Tables 23 and 24).

Table 21

Means and Standard Deviations of the Belief in Public Service Scale by Collaborative Site

	1986			1990		
Collaborative	N	Mean	SD	N	Mean	SD
Cleveland	64	3.482	.543	97	3.535	.496
Durham	46	3.621	.599	37	3.498	.465
Los Angeles	45	3.381	.499	76	3.506	.457
Memphis	--	--	--	52	3.517	.656
New Orleans	105	3.430	.470	43	3.581	.448
Philadelphia	63	3.423	.618	50	3.497	.451
Pittsburgh	79	3.436	.527	92	3.439	.450
St. Louis	--	--	--	48	3.479	.434
San Diego	46	3.484	.444	38	3.590	.526
San Francisco	66	3.570	.485	35	3.531	.464
Twin Cities	62	3.553	.499	67	3.614	.496
Total	576	3.481	.521	636	3.521	.488

Table 22

Analysis of Variance: Public Service Scale by Collaborative Site (1990 Administration)

Source	D.F	Sum of Squares	Mean Square	F
Between	10	1.703	0.170	.710*
Within	624	149.658	0.240	
Total	634	151.361		

*NS, $p > .05$.

Table 23

Means and Standard Deviations for the Public Service Scale by Collaborative Participation Level

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.444	.506	279	3.557	.487
Occasional	245	3.495	.563	309	3.498	.488
Never	172	3.496	.472	34	3.433	.499
Total	576	3.481	.521	622	3.520	.489

Table 24

Planned Holm Contrasts by Collaborative Participation Level for the Public Service Scale (1990 Administration)

Contrast	Mean Difference	D.F.	t
Frequent - Occasional	0.059	580.2	1.468
Frequent - Never	0.124	41.0	1.369
Occasional - Never	0.065	40.3	0.719
(F + O)/2 - Never	0.094	36.7	1.072
Frequent - (O + N)/2	0.091	79.2	1.706

Note: All contrasts are non-significant $p > .05$.

Teachers' beliefs about the special nature of mathematics teaching were assessed by a question in the Diary of Professional Relationships: "What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?" Responses to this inquiry revealed that teachers hold a wide range of beliefs that were not tapped by the Survey of Teacher Professionalism. These beliefs focused on three general areas: 1) Mathematics teachers help foster students' logic and critical thinking skills; 2) Mathematics teachers help students become problem-solving, informed consumers; and 3) Mathematics teachers help society by providing individuals with the knowledge and skills necessary in a technological world. Unfortunately, several teachers were unsure whether mathematics teachers contribute anything to society. Although this belief was in the minority, it is unclear at this time how widespread these feelings may be in the population of mathematics teachers in general.

Summary

Results of the Public Service Scale indicate that the approach to collaboration does impact on teachers' beliefs regarding the recognition they feel they receive from the public and the benefits they feel they contribute to society. Although the overall mean score for the Public Service Scale changed little between the 1986 and 1990 Survey administrations, the ordering of collaboratives changed in predictable and significant ways. In particular, it seems likely that teachers' beliefs interact significantly with the degree of active participation with professionals from other sectors, namely business and higher education. In addition, Frequent participants did have higher gains in their beliefs than Never participants, although these differences were non-significant.

Importance of Self-Regulation

One of the aspects that separates the professions from other occupations is the nature of quality control. Whereas non-professionals are regulated by external governing bodies, professionals organize regulatory bodies made up of fellow professionals who are viewed by their peers as being knowledgeable regarding the structure, standards, attitudes, and function of the profession. Thus, self-regulation in the teaching profession refers to the belief that since teachers are the only individuals with the knowledge of "what it takes" to be a good classroom educator, they should be the ones to evaluate their peers. In addition, classroom teachers should set the standards for what defines good teaching, and they should be the individuals empowered to effect change in the school mathematics program.

Overall, teachers were positive towards the importance of self-regulation within the mathematics teaching profession. The mean response across Self-Regulation items was 3.685, with a standard deviation of 0.432. Teachers responded similarly on the 1990 survey and the 1986 survey on items addressing Self/Peer Review. Teachers maintained their belief that parents are poor judges of good teaching; however, the mean response for Item 7 was lower in 1990 than in 1986 (see Table 25, Item 7). It is unclear at this time whether this indicates a softening of attitude towards parental judgment, or whether this difference is due to chance fluctuation.

Another item on which a decline was registered from the 1986 to 1990 Survey was "Mathematics teachers in my school are able to judge how well our mathematics department is doing" (Item 34). The mean response to this item dropped slightly, which would indicate that the respondents were less confident of the ability of teachers in their mathematics department to judge how well their department is doing. Again, it is unclear whether this trend is stable, or whether it is a function of chance variation.

Table 25

Means and Standard Deviations of Items on the Self-Regulation Scale: Self/Peer Review

Item		1986 Mean	1986 SD	1990 Mean	1990 SD
7.[a]	Mathematics teachers believe parents are in a good position to judge how well mathematics is taught in their children's schools.	3.925	.854	3.846	0.824
12.	Mathematics teachers think too much control over their work is exercised by people who lack mathematical expertise.	3.483	1.026	3.535	1.020
14.	In my view, mathematics teachers should have more freedom to collectively make decisions about their work.	3.984	.754	4.094	0.694
18.	I believe I have a high level of competence in the subject matter of all high school mathematics courses.	3.828	1.151	3.823	1.090
34.	Mathematics teachers in my school are able to judge how well our mathematics department is doing.	3.845	.848	3.766	0.835
41.	Mathematics teachers think that they should be evaluated only by other mathematics teachers.	3.148	1.037	3.309	0.993
46.	I believe that because of the degree of specialized knowledge required in teaching mathematics, only mathematics teachers are competent to judge how well other mathematics teachers do their work.	3.150	1.074	3.263	1.063

[a] Reverse item

Teachers rated items that addressed their sense of the responsibilities of professional organizations, on average, higher in 1990 than in 1986. Teachers showed much more agreement that professional mathematics education organizations should set the standards and requirements of mathematics teaching, and that these organizations should be the bodies that develop and institute changes in school mathematics (see Table 26).

Table 26

Means and Standard Deviations of Items on the Self-Regulation Scale: Organizational Responsibility

		1986		1990	
Item		Mean	SD	Mean	SD
3.	I believe that professional organizations of mathematics teachers should set the standards and requirements for teaching mathematics.	3.656	1.012	3.904	0.954
32.	Mathematics teachers think reforms in school mathematics should evolve from and be implemented through the professional mathematics education organizations.	3.312	.945	3.630	0.874

The teachers, even those who had never participated in collaborative activities, were in general agreement that the teaching profession should be self-regulating (see Table 27). Significant differences were found, however, in the strength of agreement with Self-Regulation items by collaborative participation level. Table 28 illustrates that Frequent participants rated items, on average, higher than Never participants. In addition, all collaborative participants (both Frequent and Occasional) taken as a group favored Self-Regulation more than did Never participants. A comparison of these response patterns with those reported for the 1986 administration of the Survey on Teacher Professionalism provides clear evidence for the positive impact of the collaborative. Whereas both groups of collaborative participants increased in their attitudes towards Self-Regulation, Never participants in collaborative activities decreased slightly in their support of self regulation. This differential effect points to the influence of the collaboratives on teachers' professional beliefs.

One pattern that *is* fairly easy to interpret is that there was relatively little variation in responses across sites. Over 60 percent of responses across sites fell between the range of 3.253 and 4.117. This range signifies that the majority of teachers agreed with the statements, but were not overwhelmingly approving.

Table 27

Means and Standard Deviations for the Self-Regulation Scale by Collaborative Participation Level

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.671	.450	275	3.726	.420
Occasional	245	3.579	.435	310	3.665	.437
Never	159	3.540	.430	34	3.513	.433
Total	576	3.593	.440	619	3.683	.431

Table 28

Planned Holm Contrasts by Collaborative Participation Level for the Self-Regulation Scale (1990 Administration)

Contrast	Mean Difference	D.F.	t
Frequent - Occasional	0.061	579.2	1.725
Frequent - Never	0.213	41.1	2.712*
Occasional - Never	0.151	40.7	1.936
(F + O)/2 - Never	0.182	36.9	2.387*
Frequent - (O + N)/2	0.137	80.0	2.938*

*$p < .05$.

When teachers' responses are analyzed by collaborative site, results show that the mean response to the Self-Regulation scale for every collaborative increased from 1986 to 1990. Although most of these fluctuations can be considered minimal, two collaboratives in particular showed dramatic change: Durham and Los Angeles. Teachers from these two sites increased in agreement to Self-Regulation items approximately one-half of a standard deviation since the 1986 administration.

Some of this change is attributable to the political structure of education in North Carolina and some to the changing management structure of the +PLUS+ collaborative. In the State of North Carolina, teachers do not have a teachers' union to set standards, bargain with the state, or provide a forum for debate. However, Durham Mathematics Council teachers as a group became more politically active in regard to their profession, sending letters to government officials and meeting with state mathematics representatives. In Los Angeles, the management of the collaborative has been decentralized somewhat. Satellite Councils have been set up in four geographic regions of the area so that teachers can have more say in their own governance within the UMC project. These patterns reflect the differences in approach between collaboratives with similar initial objectives. Both the Durham and the Los Angeles collaboratives addressed teacher evaluation and teacher decision-making in 1989-1990.

Overall, mean responses on the Self-Regulation scale ranged from 3.493 for San Diego to 3.798 for Philadelphia (see Table 29). These two values are significantly different at the $p < .05$ level (Tables 30 and 31). Although this difference is significant, both groups of teachers indicated that they agreed with the Self-Regulation items overall, but teachers in Philadelphia showed much higher agreement. It is unclear at this time what this difference may signify. These two collaboratives differ with respect to the status of teachers who are members: Philadelphia serves primarily secondary teachers with a great deal of experience, whereas San Diego serves primarily middle school teachers. It appears at this time that collaborative activity has not greatly affected teachers' attitudes towards this scale in these two sites.

Table 29

Means and Standard Deviations of the Self-Regulation Scale by Collaborative Site

	1986			1990		
Collaborative	N	Mean	SD	N	Mean	SD
Cleveland	64	3.628	.448	95	3.687	.431
Durham	46	3.428	.456	37	3.700	.465
Los Angeles	45	3.528	.419	79	3.730	.440
Memphis	--	--	--	48	3.785	.390
New Orleans	105	3.631	.448	44	3.722	.426
Philadelphia	63	3.706	.395	50	3.798	.452
Pittsburgh	79	3.671	.432	91	3.686	.447
St. Louis	--	--	--	49	3.592	.402
San Diego	46	3.437	.437	37	3.493	.427
San Francisco	66	3.627	.446	35	3.679	.341
Twin Cities	62	3.523	.419	67	3.619	.442
Total	576	3.593	.440	633	3.685	.432

Table 30

Analysis of Variance: Self-Regulation Scale by Collaborative Site (1990 Administration)

Source	D.F.	Sum of Squares	Mean Square	F
Between	10	3.436	0.344	1.863*
Within	621	114.493	0.184	
Total	631	117.929		

*$p < .05$.

Table 31

Post-hoc Tukey Contrasts by Collaborative Site for the Self-Regulation Scale (1990 Administration)[*]

Collaborative	Mean	Philadelphia *t*
Philadelphia	3.798	
San Diego	3.493	3.278

[*]Note: All reported *t*-values are significant $p < .05$.

The questions on the Diary of Professional Relationships that address the issue of self-regulation of mathematics teachers were designed to focus on teachers' beliefs regarding both the ideal and the real situation. That is, teachers were asked to describe the role that teachers should play in the evaluation of other teachers, as well as the role that teachers actually play in their own schools. Responses to these questions reveal an obvious dichotomy between the ideal of high self-regulation and the reality of no self-regulation.

With regard to the ideal situation, teachers' responses ranged from wanting no self-evaluation to wanting 100 percent. The majority of teachers were in favor of granting the primary responsibility for evaluation to other teachers; however, most were in agreement that other individuals, including administrators, should also be involved in the evaluation process. Thus, although mathematics teachers are the best authority on what constitutes good teaching, teachers felt they should not be granted 100 percent of evaluation responsibility.

Regarding the form of evaluation, many teachers were in favor of a collaborative, mentoring approach where ideas are shared and suggestions for improvement are made, rather than a more formal, instrument-based approach. However, several teachers were in favor of more rigorous evaluation involving state-provided instruments, *developed with teacher input*. A Durham teacher provided a concise summation of the teachers' attitudes:

> "[They should have] much more than they do. Mathematics teachers should be the ones to use the evaluation instrument provided by the state when evaluating other mathematics teachers. The

mentors, peers and others should act as coaches to beginning teachers, [and] should have a large voice in their evaluation."

When teachers' responses regarding the *reality* of peer-evaluation are analyzed, however, teachers indicated the belief that they had little or no input into their own evaluation. The overwhelming majority of responding teachers felt they had little input, and many expressed the desire to become a part of the evaluation process.

Three of the nine Self-Regulation items on the Survey of Teacher Professionalism discriminated among teachers' responses by participation level to a such a degree as to constitute definitive statements regarding differences in beliefs. Teachers' responses to Item 3 (see Tables 32 and 33) reveal that Frequent participants feel much more strongly than less frequent participants (Occasional and Never taken as a group) that professional organizations of mathematics teachers should lead the way in setting standards for the teaching of mathematics. Frequent participants in 1990 showed a marked increase in their beliefs on Item 3, whereas Never participants showed a marked *decrease*. Occasional participants showed little, if any, change. These patterns may reflect the general enthusiasm showed by the collaboratives towards the *Standards* articulated by the NCTM (1989), as well as other calls for greater teacher self-regulation.

Table 32

Means and Standard Deviations for Item 3 by Collaborative Participation Level: I believe that professional organizations of mathematics teachers should set the standards and requirements for teaching mathematics.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	158	3.223	.974	284	4.067	.954
Occasional	249	3.831	.896	320	3.778	.932
Never	170	3.918	.824	34	3.677	1.036
Total	577	3.854	.897	638	3.901	.958

Table 33

Planned Holm Contrasts by Collaborative Participation Level for Item 3 (1990 Administration)

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.289	590.0	3.752*
Frequent - Never	0.390	40.0	2.093
Occasional - Never	0.102	38.9	0.549
(F + O)/2 - Never	0.246	36.2	1.353
Frequent - (O + N)/2	0.340	72.0	3.129*

*$p < .05$

For Item 14 (see Tables 34 and 35), results show that Frequent collaborative participants felt more strongly than Occasional participants regarding the freedom of teachers to make decisions regarding their own work. Because all three levels of participants were in favor of granting teachers more freedom to make decisions about their work, it is unclear exactly what these differences mean in terms of their willingness to take advantage of freedoms that might be granted under such reform policies as school-based management systems. In addition, these results appear to have been relatively stable in the interim between 1986 and 1990. Thus, it is unclear how the collaboratives might have influenced teachers' attitudes towards collective decision-making.

The collaboratives, some more than others, had programs that addressed teacher decision-making. The Los Angeles +PLUS+ departmental planning process, for example, was devoted to teacher decision-making. The most active teachers were active participants in this process, whereas the Occasional teachers may have participated primarily through workshops. Thus, different levels of participation may have had entirely different effects on beliefs regarding teacher decision-making.

Table 34

Means and Standard Deviations for Item 14 by Collaborative Participation Level: In my view, mathematics teachers should have more freedom to collectively make decisions about their own work.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	4.019	.750	283	4.173	.740
Occasional	249	4.004	.716	319	4.038	.623
Never	173	3.948	.816	34	3.971	.792
Total	581	3.991	.755	636	4.094	.690

Table 35

Planned Holm Contrasts by Collaborative Participation Level for Item 14 (1990 Administration)

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.136	554.0	2.413*
Frequent - Never	0.203	40.1	1.410
Occasional - Never	0.067	37.4	0.475
(F + O)/2 - Never	0.135	35.8	0.966
Frequent - (O + N)/2	0.169	70.8	2.033

*$p < .05$

In addition to their stronger beliefs in freedom for collective decision-making, Frequent collaborative participants had a higher mean agreement than others regarding whether professional mathematics education organizations should be the designers and implementers of mathematics education reforms (see Tables 36 and 37). Again, Frequent participants showed a significantly higher mean rating than Occasional participants. Non-significant differences were found between Occasional and Never participants, and between Frequent and Never participants. This too may be related to the NCTM *Standards*. Frequent participants may have become more acquainted with the notion due to the emphasis placed on the *Curriculum and Evaluation Standards* (NCTM, 1989) by the collaborative leaders across sites.

Table 36

Means and Standard Deviations for Item 32 by Collaborative Participation Level: Mathematics teachers think reforms in school mathematics should evolve from and be implemented through the professional mathematics education organizations.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.509	1.055	281	3.751	.871
Occasional	247	2.911	1.028	320	3.522	.864
Never	172	2.448	.999	34	3.618	.922
Total	578	2.938	1.101	635	3.628	.876

Table 37

Planned Holm Contrasts by Collaborative Participation Level for Item 32 (1990 Administration)

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.229	587.6	3.229*
Frequent - Never	0.133	40.5	0.801
Occasional - Never	-0.096	39.4	0.580
(F + O)/2 - Never	0.019	36.4	0.116
Frequent - (O + N)/2	0.181	75.1	1.855

*$p < .05$

Summary

Results on the Self-Regulation Scale provide additional evidence that what the collaboratives emphasized had an impact on teachers' attitudes. The slight increase in mean score on Self-Regulation between 1986 and 1990 indicates a change in teachers' attitudes about making their own decisions. The large increases by teachers from Durham and Los Angeles, two collaboratives that engaged teachers more in decision-making, support the notion that collaborative activities that directly address these issues have a positive influence on teachers feelings' toward Self-Regulation. Collaborative participation, in general, has improved teachers' attitudes regarding the role of professional organizations in setting standards and leading reform, and on the issue of mathematics teachers having more freedom to make decisions regarding their profession. In other words, the UMC project has had significant effects on teachers' attitudes toward increased self-regulation through informed decision-making.

Importance of Sense of Calling

Sense of Calling, as it relates to the professionalism of teachers, refers to the commitment a teacher feels for his or her work. It alludes to a teacher's dedication to the teaching profession, the sense of identity a teacher feels with the profession (whether a teacher thinks of himself/herself primarily as a teacher or as a mathematician, or both), and the professed need for additional training to keep abreast of new knowledge and practices in the profession.

The overall mean response to the Sense of Calling Scale was 3.775, with a standard deviation of 0.354 (see Table 41 on p. 50). This mean value represents a slight increase since the 1986 administration of the Survey of Teacher Professionalism (*M* = 3.690, *SD* = .388). The low standard deviation indicates that very few teachers disagreed with most of the Sense of Calling items, and in addition, few teachers were in high agreement.

In response to items measuring their sense of dedication to their profession (see Table 38), teachers indicated they felt a moderately strong sense of dedication and that they believed they could maintain enthusiasm for teaching. Their motivations for teaching include enjoyment of working with students and the enjoyment of mathematics itself. However, their sense of dedication was not so strong that they would stay in the teaching profession if their salaries were reduced. Teachers by and large disagreed with Item 47, which addresses salary reduction, although there was some variation in responses. Although the responses to all five Dedication items on the Sense of Calling Scale showed higher mean scores on the 1990 administration, the magnitudes of these item means are very similar to those reported in 1986.

Table 38

Means and Standard Deviations of Items on the Sense of Calling Scale: Dedication

Item		1986		1990	
		Mean	SD	Mean	SD
11.	Mathematics teachers display dedication to their work.	4.073	.684	4.106	.675
17.[a]	I feel that even with professional contacts, it is difficult to maintain enthusiasm about teaching mathematics.	3.623	1.063	3.713	.926
29.	Mathematics teachers are teachers primarily because they enjoy working with young people.	3.686	.877	3.707	1.01
44.	I teach because I enjoy mathematics.	4.096	.825	4.150	.793
47.	I would stay in the teaching of mathematics even if my salary were reduced.	2.457	1.199	2.670	1.17

[a] Reverse Item

With regards to their professional identification, teachers indicated that they see themselves more as teachers than as mathematicians (see Table 39). Agreement with both Item 15 and Item 36 was moderately high, and variation in responses was moderate, with very few teachers disagreeing with the statement.

Table 39

Means and Standard Deviations of Items on the Sense of Calling Scale: Teacher or Mathematician

Item		1986		1990	
		Mean	SD	Mean	SD
15.	I think of myself first as a teacher, then as a mathematician.	4.083	.851	4.184	.780
36.	Mathematics teachers consider themselves as teachers more so than as mathematicians.	3.898	.735	3.916	.610

Although teachers agreed that time spent on continued training in mathematics is well spent, they were less supportive of the belief that training in mathematics is more important than training in effective teaching and classroom management (see Table 40). These results seem to confirm that teachers see their profession as requiring unique knowledge not possessed by either the mathematics community, or the community of educators in general. Thus, respondents seem to view themselves as *teachers of mathematics*.

Table 40

Means and Standard Deviations of Items on the Sense of Calling Scale: Need for Continued Training

		1986		1990	
Item		Mean	SD	Mean	SD
8.[a]	Mathematics teachers think that it is more important to receive continued training in mathematics than it is to receive training in effective ways to teach and manage classes.	3.255	1.052	3.337	1.02
21.	I believe that time I spend on continued training in mathematics is well spent.	4.047	.802	3.916	.610

[a] Reverse Item

When teachers' responses are examined by collaborative site, one finds that all collaboratives reported fairly high mean ratings on the Sense of Calling Scale, with all ratings higher in 1990 than in 1986 (see Table 41). The collaboratives showing the biggest jump in ratings were New Orleans and San Diego. Interestingly, while New Orleans teachers had one of the highest mean scores for items addressing Dedication (M = 3.760), they showed the lowest mean rating of items addressing whether they considered themselves Teachers more than Mathematicians (M = 3.955). In contrast, San Diego teachers rated Dedication items, on average, lower than the other collaboratives (M = 3.626), while they rated the Teacher or Mathematician items higher (M = 4.263).

Although an analysis of variance detected significant differences across collaborative sites (see Table 42), Tukey comparisons detected non-significant pairwise differences. Thus, the differences that do exist for the Sense of Calling Scale are uninterpretable across collaborative sites.

On the Diary of Professional Relationships, respondents were asked whether they define themselves primarily as Teachers or as Mathematicians. Teachers from all of the collaborative sites indicated, for the most part, that they consider themselves teachers. In their responses, most teachers emphasized their love for teaching and working with students as their primary motivations. Many teachers also emphasized their perception that being a mathematician involves rigorous study of theoretical mathematics, something that they are not involved in.

An interesting distinction between these two positions was made by teachers in the San Francisco collaborative. One teacher said, "[I am] a teacher. I don't really do math; I just teach it. How do ordinary people do math? I just do arithmetic--consumer math. My major job is to get information across but not really do it." In contrast, the second teacher replied, "Maybe we should see ourselves as mathematicians. Maybe if we could see ourselves as mathematicians and get kids to think of themselves that way maybe we wouldn't lose so many people--teachers and students."

A teacher from the Twin Cities appears to have summed up the attitudes of the group in responding: "I am a teacher first. That is what I always wanted to be."

Table 41

Means and Standard Deviations of the Sense of Calling Scale by Collaborative Site

	1986			1990		
Collaborative	N	Mean	SD	N	Mean	SD
Cleveland	64	3.663	.348	98	3.788	.348
Durham	46	3.727	.350	37	3.739	.300
Los Angeles	45	3.625	.370	80	3.739	.374
Memphis	–	–	–	50	3.691	.314
New Orleans	105	3.671	.421	44	3.808	.350
Philadelphia	63	3.739	.441	50	3.811	.351
Pittsburgh	79	3.607	.409	88	3.705	.369
St. Louis	–	–	–	45	3.725	.393
San Diego	46	3.659	.359	38	3.848	.403
San Francisco	66	3.736	.399	35	3.835	.405
Twin Cities	62	3.801	.303	67	3.887	.262
Total	576	3.690	.388	633	3.775	.354

Table 42

Analysis of Variance: Sense of Calling Scale by Collaborative Site (1990 Administration)

Source	D.F.	Sum of Squares	Mean Square	F
Between	10	2.352	0.235	1.898*
Within	621	76.940	0.124	
Total	631	79.292		

$^*p < .05$

Responses analyzed by participation level indicate that Frequent participants, on average, agreed with Sense of Calling items more than Never participants and less frequent participants (Occasional and

Never taken as one group). While both Frequent and Occasional participants showed higher agreement since the 1986 administration, Never participants showed very little, if any, change over time (see Tables 43 and 44). This gain in group scores would indicate some impact of collaborative participation.

Table 43

Means and Standard Deviations for the Sense of Calling Scale by Collaborative Participation Level

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.778	.366	280	3.810	.360
Occasional	245	3.649	.387	306	3.762	.346
Never	172	3.668	.398	34	3.667	.346
Total	576	3.690	.388	620	3.779	.353

Table 44

Planned Holm Contrasts by Collaborative Participation Level for the Sense of Calling Scale (1990 Administration)

Contrast	Mean Difference	D.F.	t
Frequent - Occasional	0.048	574.2	1.635
Frequent - Never	0.143	42.1	2.270*
Occasional - Never	0.096	40.7	1.527
(F + O)/2 - Never	0.119	37.1	1.954
Frequent - (O + N)/2	0.096	85.4	2.517*

*$p < .05$

Item 21, which addressed the value of time spent on continued training in mathematics, was the only item on the Sense of Calling Scale that discriminated between participation levels. Table 45 presents the means and standard deviations by participation level, and Table 46 presents the planned contrasts.

As can be seen, a direct relationship exists between the level of participation and the belief in the importance of continued training in mathematics. While Never participants were fairly neutral towards continued mathematical training, Occasional participants were quite positive, and Frequent participants were highly enthusiastic. In fact, almost none of the Frequent participants felt less than neutral towards Item 21. The difference between the mean rating for Frequent and Never participants exceeds 1.25 standard deviations.

Table 45

Means and Standard Deviations for Item 21 by Collaborative Participation Level: I believe that time I spend on continued training in mathematics is well spent.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	4.403	.541	284	4.342	.688
Occasional	249	3.940	.852	320	4.091	.700
Never	172	3.884	.830	34	3.382	1.155
Total	580	4.050	.801	638	4.165	.758

Table 46

Planned Holm Contrasts by Collaborative Participation Level for Item 21 (1990 Administration)

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.251	595.8	4.438*
Frequent - Never	0.959	35.9	4.742*
Occasional - Never	0.708	35.6	3.508*
(F + O)/2 - Never	0.834	34.4	4.167*
Frequent - (O + N)/2	0.605	48.1	5.556*

*$p < .05$

Summary

Results of the Sense of Calling Scale indicate that collaborative participation is related to an increase in teachers' sense of calling. In particular, teachers who have been active in the collaborative value continued training in mathematics significantly more than non-participants. All collaboratives have provided teachers with some professional development activities. This initiative by the collaboratives appears to have a noticeable influence on teachers' interest in continued training. In addition, collaborative participation does have an effect on teachers' dedication to their work, their feelings of being a *teacher* of mathematics, and their positive views toward continuing education.

Autonomy

Autonomy, Hall's fifth professional attribute, embodies the desire of professionals to make their own professional decisions, without coercion from outside forces, and the expectation that others will have confidence in their professional judgment. Two areas of autonomy are of special importance to teachers: autonomy in making classroom decisions, and autonomy in reviewing their professional decisions.

In the 1990 administration of the Survey, the grand mean of items on the Autonomy Scale was 3.617, and the standard deviation was 0.395. Like the other four scales of the Survey, this represents an increase in agreement since 1986 (see Table 49).

Teachers' beliefs regarding autonomy in decision-making reveal that they see themselves as being the most appropriate people to make decisions about mathematics instruction, and that they feel they have the opportunity to make such decisions every day (see Table 47). However, teachers are somewhat divided on whether final decisions regarding mathematics instruction should rest upon the shoulders of mathematics teachers. In addition, teachers feel, to a large extent, that they do not have the control that they should have over their everyday work. This pattern of responses across items seems to indicate that although teachers are given some autonomy and do make decisions within the bounds of the autonomy they are given, often in the process of teaching mathematics they must function beyond the boundaries of given responsibility such that they lose ultimate control over their work.

Table 47

Means and Standard Deviations of Items on the Autonomy Scale: Autonomy in Making Decisions

Item		1986 Mean	1986 SD	1990 Mean	1990 SD
4.[a]	I don't have the opportunity to exercise my own judgment in my work.	3.930	.881	4.007	.803
19.	I believe that the final decision on the content of mathematics instruction should be made by individual mathematics teachers.	2.816	1.145	2.910	1.14
37.	In practice, mathematics teachers are the ones who determine what is actually taught in the courses they teach.	3.438	1.070	3.439	1.02
38.	Mathematics teachers believe they have the control that they should have over their everyday work.	3.052	1.033	2.986	1.01
42.	Mathematics teachers make decisions about their everyday work.	4.005	.651	3.952	.645
45.	Mathematics teachers are the most appropriate people to make decisions about methods of mathematics instruction.	3.786	.907	4.132	.698
49.	I make my own decisions in regard to my everyday work.	3.892	.809	3.839	.772

[a] Reverse Item

Although teachers' responses to having their daily decisions reviewed by the chair of their mathematics department ranged from neutrality to disagreement, they were highly negative towards allowing members of the district administration the final responsibility for what is taught in school mathematics (see Table 48). Both of these sentiments echo teachers' ratings in 1986. This response would be expected of a group of professionals. Since mathematics department chairs are teachers and, thus, members of the profession, they should be regarded as much more appropriate for reviewing decisions than "outsiders" such as principals or assistant superintendents.

Table 48

Means and Standard Deviations of Items on the Autonomy Scale: Review of Decisions

Item		1986		1990	
		Mean	SD	Mean	SD
23.[a]	Decisions I make in my daily work should be subject to review by the chair of our mathematics department.	3.411	1.061	3.143	1.06
43.[a]	I think district administrators should have the final responsibility for what is taught in school mathematics.	3.974	.920	3.954	.840

[a]Reverse item

When teachers' responses to the Autonomy Scale are analyzed by collaborative site, results indicate that in six sites, teachers' ratings increased slightly from 1986 to 1990 (see Table 49). The largest increase in attitude towards Autonomy items was by teachers in San Diego.

Overall, responses ranged from a mean of 3.712 in Los Angeles to a mean of 3.465 in New Orleans (see Tables 49, 50, & 51). While this difference in mean response is significant, it is unclear how to interpret the findings since teachers in both collaboratives show a fairly positive view towards the Autonomy items.

While teachers in 6 of the 11 collaboratives showed an increase in agreement towards Autonomy items, teachers in Durham, New Orleans, and the Twin Cities were not as favorable in 1990 as they were in 1986.

Table 49

Means and Standard Deviations of the Autonomy Scale by Collaborative Site

	1986			1990		
Collaborative	N	Mean	SD	N	Mean	SD
Cleveland	64	3.614	.432	99	3.649	.403
Durham	46	3.667	.336	37	3.550	.366
Los Angeles	45	3.704	.381	79	3.712	.419
Memphis	--	--	--	50	3.542	.356
New Orleans	105	3.547	.419	44	3.465	.376
Philadelphia	63	3.481	.353	47	3.572	.372
Pittsburgh	79	3.496	.344	89	3.603	.383
St. Louis	--	--	--	46	3.546	.343
San Diego	46	3.473	.421	38	3.673	.485
San Francisco	66	3.641	.370	35	3.705	.379
Twin Cities	62	3.756	.350	67	3.685	.389
Total	576	3.590	.391	632	3.617	.395

Table 50

Analysis of Variance: Autonomy Scale by Collaborative Site (1990 Administration)

Source	D.F.	Sum of Squares	Mean Square	F
Between	10	3.316	0.332	2.168*
Within	620	94.821	0.153	
Total	630	98.138		

*$p < .05$

Table 51

Post-hoc Tukey Contrasts by Collaborative Site for the Autonomy Scale[*] *(1990 Administration)*

		Los Angeles
Collaborative	Mean	*t*
Los Angeles	3.712	
New Orleans	3.465	3.358

[*]Note: All reported *t*-values are significant $p < .05$.

Non-significant differences were found between teachers' ratings across participation level (see Table 52). This may be due to the great variety of situations covered by the items in the scale. Teachers may have different conceptions regarding their autonomy on their home turf (the classroom) as compared with the school at large.

Teachers' responses to the Diary of Professional Relationships show considerable variation both between and within sites. They were first asked to indicate the role that teachers should have in determining the basic content that is taught in mathematics courses, then they were asked to indicate the input they actually have in determining content. Again, like the responses to the ideal and the real situations for self-regulation, teachers seemed to perceive a dichotomy.

With regards to their perceptions of the ideal situation, teachers believe that they should be given considerable input in determining course content. However, they also believe that others--namely, mathematics educators from higher education and professional organizations like the NCTM--should set general goals and guidelines based on research. Thus, teachers want more freedom to determine the mathematics they teach, but are not willing to grant themselves full license. Most teachers emphasized that the determination of content should be a collaborative process rather than one mandated by the state or by a few individuals.

When describing the reality of classroom teaching, however, many teachers admitted that they had little input. Many indicated that state-mandated textbook selection and curriculum guidelines restricted their ability to modify content. This varied from teacher to teacher, however, as some were given more freedom than others, depending upon collaborative site, or upon school structures within a site. Some of the greatest within-site variation in response came from St. Louis teachers. One teacher indicated that all of the teachers in his/her school were involved in pilot curriculum programs, while another felt that none of the teachers in his/her school had any input.

Table 52

Means and Standard Deviations for the Autonomy Scale by Collaborative Participation Level

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	3.632	.383	278	3.645	.394
Occasional	245	3.550	.367	307	3.595	.400
Never	172	3.607	.427	33	3.596	.375
Total	576	3.590	.391	618	3.617	.396

One item from the Autonomy Scale did discriminate effectively between participation levels. Results for Item 4 indicate that Frequent participants feel they have more opportunity to exercise their own judgment in their own work than either Occasional participants, or less frequent participants (Occasional and Never participants treated as one group). Refer to Tables 53 and 54 for descriptive statistics and contrast data.

Table 53

Means and Standard Deviations for Item 4 by Collaborative Participation Level: I don't have the opportunity to exercise my own judgment in my work.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	159	4.038	.856	284	4.113	.729
Occasional	247	3.842	.904	319	3.937	.826
Never	173	3.931	.893	34	3.765	1.017
Total	579	3.922	.890	637	4.006	.801

Table 54

Planned Holm Contrasts by Collaborative Participation Level for Item 4 (1990 Administration)

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.175	601.0	2.770*
Frequent - Never	0.348	37.2	1.937
Occasional - Never	0.173	37.8	0.957
(F + O)/2 - Never	0.260	35.2	1.469
Frequent - (O + N)/2	0.262	56.8	2.616*

*$p < .05$

Summary

Although the survey data indicates that teacher autonomy has been affected by the collaboratives, regional differences also seem to be an important factor. The four collaboratives with highest mean scores on the Autonomy Scale were the three California collaboratives and the Twin Cities. The four collaboratives with the lowest mean scores were located in the Southern or Central region of the country.

Collaborative participation seems to give teachers more confidence in exercising their own judgment in their teaching. However, autonomy in other areas seems to be related to other factors, one of which is area of expertise. More respondents than not believed that teachers should not make the final decision on content. Rather, other interested and informed parties should be involved in the decision to include or deemphasize content topics. Teachers are more willing for decisions on *curriculum* to be cooperative rather than left to any one person, whether a teacher or a member of the district administration. When it comes to actual classroom practice, however, the collaborative teachers are more adamant about making their own decisions. This is where collaborative participation seems to have the greatest influence.

Impact Items

Six items were added to the Survey of Teacher Professionalism for the 1990 administration. These items specifically addressed teachers' beliefs regarding the impact of the local collaborative on their professionalism. Five of the six items discriminated effectively between participation levels, indicating fairly strongly that the collaborative project has indeed had an impact on the professional attitudes of participating teachers. Item 48 (The collaborative has expanded my notion of what it means to be a mathematics teacher) showed nonsignificant differences between participation levels. Responses to Item 6 (see Tables 55 and 56), for example, indicate that there is a direct relationship between teachers' level of participation and the perceived impact of the collaborative on teachers' leadership qualities. Frequent participants felt strongly that the collaborative has helped them to improve their leadership potential. Occasional participants were more neutral, with a slight tendency for agreement. Never participants were in disagreement with the statement. The differences in means for all pairwise comparisons and the two important complex comparisons were significant $p < .05$.

Table 55

Means and Standard Deviations for Item 6 by Collaborative Participation Level: The collaborative has helped me to develop leadership qualities.

Participation Level	N	Mean	Standard Deviation
Frequent	284	3.909	.920
Occasional	319	3.172	.842
Never	34	2.618	.739
Total	637	3.471	.964

Table 56

Planned Holm Contrasts by Collaborative Participation Level for Item 6

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.736	576.9	10.203*
Frequent - Never	1.291	46.2	9.352*
Occasional - Never	0.555	42.7	4.102*
(F + O)/2 - Never	0.923	38.5	7.002*
Frequent - (O + N)/2	1.013	109.4	11.660*

*$p < .05$

One objective of the UMC project throughout its development has been that of increasing the equity of mathematics education in our urban schools. Analysis of Item 9 indicates that Frequent participants were more attuned to equity issues than Never participants (see Tables 57 and 58). In addition, collaborative participants in general (Frequent and Occasional participants treated as one group) believed more strongly that teachers have a major responsibility to ensure equity in their mathematics classrooms than did Never participants.

Table 57

Means and Standard Deviations for Item 9 by Collaborative Participation Level: Mathematics teachers have a major responsibility to ensure that all students have equal opportunity to learn mathematics.

Participation Level	N	Mean	Standard Deviation
Frequent	282	4.333	.775
Occasional	317	4.183	.806
Never	34	3.853	.926
Total	633	4.232	.806

Table 58

Planned Holm Contrasts by Collaborative Participation Level for Item 9

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.150	593.4	2.326*
Frequent - Never	0.480	38.8	2.906*
Occasional - Never	0.330	38.6	2.000
(F + O)/2 - Never	0.405	35.8	2.502*
Frequent - (O + N)/2	0.315	65.6	3.336*

*$p < .05$

Moreover, this difference in heightened awareness of equity can be directly attributed to the influence of the collaborative. Table 59 presents the mean and standard deviations of Item 13, which address the impact of the collaborative on raising teachers' awareness of equity issues. Frequent participants agreed fairly strongly that the collaborative has helped them become more aware of equity issues concerning school mathematics. Occasional participants were more neutral, but still agreed with the item. However, Never participants showed disagreement with the statement, as would be expected. These differences in mean ratings were significant across all contrasts of interest (see Table 60).

Table 59

Means and Standard Deviations for Item 13 by Collaborative Participation Level: The collaborative has raised my awareness of equity issues concerning school mathematics.

Participation Level	N	Mean	Standard Deviation
Frequent	282	3.911	.841
Occasional	316	3.370	.828
Never	34	2.794	.808
Total	632	3.581	.892

Table 60

Planned Holm Contrasts by Collaborative Participation Level for Item 13

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.541	586.0	7.913*
Frequent - Never	1.117	42.1	7.580*
Occasional - Never	0.576	40.8	3.940*
(F + O)/2 - Never	0.847	37.1	5.930*
Frequent - (O + N)/2	0.829	85.4	9.356*

*$p < .05$

Tables 61 and 62 provide the descriptive statistics and contrast data for Item 16, which addresses the impact of the collaborative on enhancing teachers' professional lives. Again, as expected, a direct relationship is apparent between teachers' responses to Item 16 and their participation level in the collaborative. Moreover, when examining the mean values across participation levels, an interesting finding immediately appears. Even a majority of teachers who have never participated in collaborative activities acknowledge that the collaborative has enhanced the professional lives of mathematics teachers. This is suggestive, to some extent, of the dramatic increase in the number of teachers who are becoming members of the collaboratives, or who are affected by the project in one way or another. Teachers who have never participated in a collaborative evidently hear about its successes, acknowledge them, and, in some documented cases, have "given it a try."

Table 61

Means and Standard Deviations for Item 16 by Collaborative Participation Level: The collaborative has enhanced the professional lives of mathematics teachers.

Participation Level	N	Mean	Standard Deviation
Frequent	283	4.283	.738
Occasional	318	3.849	.763
Never	34	3.118	.808
Total	635	4.003	.810

Table 62

Planned Holm Contrasts by Collaborative Participation Level for Item 16

Contrast	Mean Difference	D.F.	t
Frequent - Occasional	0.434	595.0	7.077*
Frequent - Never	1.165	39.9	8.018*
Occasional - Never	0.731	39.6	5.045*
(F + O)/2 - Never	0.948	36.3	6.684*
Frequent - (O + N)/2	0.799	72.4	9.435*

*$p < .05$

Teachers' responses to Item 26, which addresses the collaborative's contribution to helping teachers assume leadership roles, follow a similar pattern (see Tables 63 and 64). Frequent participants were in strong agreement that the collaborative has helped teachers assume leadership roles, Occasional participants were in moderate agreement, and Never participants were fairly neutral. Again, however, the descriptive statistics pertaining to the Never group indicate that many Never teachers acknowledge the impact of the collaborative on other teachers' leadership. The differences between participation level and response to Item 26 were all significant $p < .05$ (see Table 64).

Table 63

Means and Standard Deviations for Item 26 by Collaborative Participation Level: The collaborative has contributed to teachers assuming leadership roles.

Participation Level	N	Mean	Standard Deviation
Frequent	283	4.138	.776
Occasional	320	3.631	.740
Never	34	3.029	.577
Total	637	3.824	.809

Table 64

Planned Holm Contrasts by Collaborative Participation Level for Item 26

Contrast	Mean Difference	D.F.	*t*
Frequent - Occasional	0.507	584.0	8.180*
Frequent - Never	1.108	48.6	10.159*
Occasional - Never	0.602	45.4	5.615*
(F + O)/2 - Never	0.855	39.8	8.253*
Frequent - (O + N)/2	0.808	126.3	11.423*

*$p < .05$

Teachers' responses to the Diary of Professional Relationships provide support for these findings. Teachers were asked "How has the collaborative enhanced your view as a professional?" Although there was some variation, the responses were overwhelmingly positive. Responses tended to fall into three types of effects: 1) Enhancement of professional education opportunities; 2) an expanded view of mathematics and mathematics education; and 3) interpersonal support and increased interest towards mathematics teaching.

A teacher from Pittsburgh commented, "[It has increased my] general knowledge. Being able to meet other professional people and get ideas." Another teacher from Durham echoed these sentiments, "It has given me an opportunity to attend conferences and further my education. It has made me aware of other math teachers and how to excel in my profession."

A primary teacher in San Francisco related how the collaborative helped him/her to see the importance of grade level in the development of mathematical knowledge. "It [the Collaborative] has enhanced my view of math education. As a primary teacher I've dealt with primary issues. The collaborative has a broader view. I see how first grade lays the framework. I see math as much more open-ended now."

By far, the most common response to the Diary of Professional Relationships question addressed the interpersonal support and encouragement that the collaboratives have fostered. Many teachers focused on the respect and professional treatment they receive from the other collaborative members as helping them to feel better about themselves as teachers and to become more enthusiastic about their profession.

Several teachers had not thought of mathematics teaching as a profession before their participation in the collaborative. For example, a teacher from Los Angeles volunteered, "I am more certain there is a profession of teaching. The collaborative establishes it as a profession not just a job. I never realized that until my department got involved in PLUS [the local collaborative]."

Most teachers in response to this query indicated that the collaborative treated them in a manner far different from what they had been accustomed to--as a professional who contributes to the success of students, the educational system, and society. One teacher from the Twin Cities poignantly responded, "I am treated with respect and dignity."

Effects of Collaborative Activity on Individual Teachers in Terms of Hall's Five Factors

Two hundred twenty-eight of the teachers who participated in the 1986 administration of the Survey of Teacher Professionalism also participated in the administration of the 1990 Survey. Table 65 provides a cross-tabulation of their reported participation levels across both survey administrations. As can be seen, the proportion of respondents from the three participation levels in 1986 is approximately equal, while by 1990, these proportions had changed dramatically.

Sixty-five percent of Frequent participants in 1986 reported no change in their participation level, while 35 percent indicated that their level of participation had dropped to Occasional. Interestingly, *none* of the 1986 Frequent participants dropped out of the collaborative completely in 1990--none of these teachers indicated that they never participated in collaborative activities. Of those teachers who perceived themselves as Occasional participants in 1986, 65 percent stayed the same. However, 34 percent reported that they had changed from Occasional participants to Frequent participants, nearly the exact proportion of the 1986 Frequent participants who had become Occasional in 1990. In 1990, only 2 percent of 1986 Occasional participants reported that they never attended collaborative activities.

The most notable findings presented in Table 65 are those for the 1986 Never participants. Of the 60 respondents, only seven (12%) indicated in 1990 that they still were not participating in the collaborative. Sixty percent of the 1986 Never participants now participate occasionally in the collaborative, and 28 percent participate frequently. In sum, nearly **90 percent** of teachers who reported that they never participated in collaborative activities in 1986 became involved in the collaborative by 1990, while *none* of the Frequent participants in 1986 dropped out.

Table 65

Cross-tabulation of Reported Participation Level for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism

		1986			
		Frequent	Occasional	Never	Total
	Frequent	51	29	17	97
1990	Occasional	27	54	36	117
	Never	0	2	7	9
	Total	78	85	60	223

These figures help to explain why the Documentation Project has had difficulty obtaining repeated information from individuals who are not participating in the local collaboratives. When teachers hear about what the collaboratives are doing and receive support from collaborative members, they tend to become active. One teacher from Cleveland, in an interview with Documentation Project staff, volunteered his opinions of the collaborative even though he himself had never actually participated. This serves to illustrate the impact that collaborative members can have on other teachers in their schools.

> "I have a feeling of professionalism because of the collaborative even though I've been involved only minimally. Things that are brought back to the school by other people via the bulletin board--[mathematics] problems into the teachers' lounge . . . it's a good feeling. There was interaction before the collaborative, but there's more interaction and more professionalism. I feel more of a cohesiveness in the department that's very positive. . . .
>
> With the collaborative, they get you involved and show you how and what is the latest in the field. They got me into computers. The people who are very much involved now are the carriers of all this information down to people like myself. . . .
>
> There was rigidity before . . . we were free to try things but we didn't know the possibilities... we're encouraged to try things and we feel comfortable doing them . . . when you see 4 to 5 guys doing things, there isn't any reason to try things . . . an active group makes you want to be involved. . . .
>
> I missed out by dragging my feet, so this year I plan to go. . . .
>
> I wish they could get to all the schools. Everybody should at least try it. Just try it!. . . .
>
> . . . I enjoy coming into work after 21 years because of the influence of the collaborative.

> . . . You're not alone. You have backup all over the place. . . .Help is always there. Nothing can go wrong now that you used to dread."

Some caution must be taken, however, in the interpretation of these results. Since the Documentation Project requested that the collaborative administrators distribute the Survey of Teacher Professionalism to teachers who had already taken the survey in 1986, these results are interpretable only for these teachers. They do not necessarily reflect the change in attitudes of all collaborative members. In addition, the small number of Never participants in 1990 makes interpretation of group differences difficult, since the power needed to determine statistical significance is proportional to group size. Moreover, since the group membership of the collaboratives has changed since the 1986 administration, participation levels represent entirely different groups of teachers in 1990. Thus, any interpretation of within-subjects results must be made in relation to these dynamics.

Keeping this caveat in mind, this section describes changes in attitudes for teachers who have been exposed to collaborative activities since the beginning stages. These results are presented in a format similar to that of the previous section: First, teachers' overall responses to the five Professionalism Scales will be reported; and second, teachers' responses will be analyzed with reference to the point at which they became involved in the project. Lastly, the factor structure of the scale items will be analyzed with particular attention to consistency of structure over time. As the pattern of teachers' attitudes unfold, it will be compared to the general descriptions given in Romberg et al. (1988), and earlier in this document.

Professional Organization as a Major Referent

Results of repeated measures analysis of variance for the Professional Organization Scale revealed that these teachers, as a whole, increased in their agreement with scale items since 1986 (see Tables 66 and 67). While the ANOVA uncovered significant differences across participation level, results for participation level over time (participation level by Professional Organization) were non-significant. Thus, although teachers' attitudes changed predictably over time, and teachers' attitudes differed according to their participation level, the data are inconclusive in indicating that those who were more active in the collaborative had more positive attitudes toward professional organizations and the role they should have in the process of reform.

Table 66

Means and Standard Deviations for the Professional Organization Scale for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	95	3.504	.463	97	3.693	.462
Occasional	115	3.356	.510	114	3.471	.467
Never	9	2.679	.335	9	3.099	.610
Total	219	3.392	.510	220	3.554	.490

Table 67

Repeated Measures Analysis of Variance for the Professional Organization Scale by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	10.07	5.04	13.92*
Within Cells	214	77.43	0.36	
Within Subjects				
Professional Organization	1	2.06	2.06	21.46*
Participation Level X Prof. Org.	2	0.40	0.20	2.10
Within Cells	214	20.58	0.10	

*$p < .05$

Results indicate that, in general, teachers felt more comfortable meeting with mathematicians from business and industry in 1990 than in 1986. Tables 68 and 69 reveal significant differences between teachers' responses across the two survey administrations for this item. Again, however, though Frequent participants scored significantly higher for this item than the other two participation levels, no interaction between participation level and time was evident.

Table 68

Means and Standard Deviations for Item 1[a] for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I feel out of place meeting with mathematicians from businesses and universities.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	96	4.052	.933	97	4.247	.722
Occasional	117	3.915	.867	117	3.906	1.059
Never	9	2.556	1.013	9	3.333	1.118
Total	222	3.919	.943	223	4.031	.951

[a] Reverse Item

Table 69

Repeated Measures Analysis of Variance for Item 1[a] by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	25.70	12.85	11.30*
Within Cells	219	248.98	1.14	
Within Subjects				
Item 1	1	3.52	3.52	6.50*
Participation Level X Item 1	2	3.12	1.56	2.88
Within Cells	219	118.59	0.54	

*$p < .05$

[a] Reverse Item

Teachers in all three participation levels were fairly neutral overall towards reading professional publications, with a fair number in each level agreeing with the statement, and a fair number disagreeing. While both the Occasional and Never participants increased in their beliefs that mathematics teachers regularly read professional publications, Frequent participants showed little change, and what change there was in a *negative* direction (see Tables 70 and 71).

Table 70

Means and Standard Deviations for Item 5 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: Mathematics teachers regularly read journals and publications about mathematics and its applications.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.113	.999	97	2.918	.997
Occasional	116	2.905	.942	117	3.162	.947
Never	9	2.556	.882	9	3.111	.928
Total	222	2.982	.970	223	3.054	.971

Table 71

Repeated Measures Analysis of Variance for Item 5 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	0.68	0.34	0.24
Within Cells	219	306.18	1.40	
Within Subjects				
Item 5	1	1.47	1.47	3.10
Participation Level X Item 5	2	6.55	3.28	6.91*
Within Cells	219	103.87	0.47	

*$p < .05$

As expected, Frequent participants remained more strongly in favor of the role of professional mathematics education organizations in changing school mathematics than did either Occasional or Never participants (see Tables 72 and 73 for analyses of Item 20 responses). In addition, teachers from all three participation levels increased in their acknowledgement of this important role since 1986.

Table 72

Means and Standard Deviations for Item 20 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I believe that professional mathematics education organizations at the local level should play a vital role in changing school mathematics.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.670	.851	97	3.938	.761
Occasional	117	3.521	.896	116	3.707	.834
Never	9	2.889	1.167	9	3.667	.500
Total	223	3.561	.898	222	3.806	.798

Table 73

Repeated Measures Analysis of Variance for Item 20 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	6.83	3.42	3.84*
Within Cells	219	197.03	0.90	
Within Subjects				
Item 20	1	5.79	5.79	11.13*
Participation Level X Item 20	2	1.54	0.77	1.48
Within Cells	219	113.89	0.52	

*$p < .05$

Similarly, teachers from all participation levels increased their agreement that their colleagues believe in the importance of supporting mathematics education organizations at the local level (Item 24). Surprisingly, non-significant differences were found between participation level, or for the interaction between participation level and administrations (see Tables 74 and 75). This is particularly surprising given the dynamics of group membership. If the Never participants in 1986, on the whole, increased their participation level over time, they might be expected to show a larger increase in their support for local professional organizations than those with a greater level of participation in 1986. Thus, one would expect that the Frequent and Occasional groups in 1990, which include a larger number of these teachers who have changed in participation level, would show a larger increase in support.

Table 74

Means and Standard Deviations for Item 24 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: Mathematics teachers believe it is important to support professional mathematics education organizations at the local level.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.330	.943	97	3.577	.852
Occasional	117	3.316	.962	117	3.521	.943
Never	9	2.667	.707	9	3.000	1.000
Total	223	3.525	.909	223	3.296	.950

Table 75

Repeated Measures Analysis of Variance for Item 24 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	6.37	3.19	2.52
Within Cells	220	278.04	1.26	
Within Subjects				
Item 24	1	2.38	2.38	5.25*
Participation Level X Item 24	2	0.10	0.05	0.11
Within Cells	220	99.57	0.45	

*$p < .05$

Results for Item 27 indicate that more of the participants believe in 1990 that mathematics teachers feel it is important to meet with other mathematicians from business and university, than did in 1986. Although the pattern of responses across participation level showed Frequent participants with a significantly higher level of agreement, it is unclear whether there were any differential effects across time (see Tables 76 and 77).

Table 76

Means and Standard Deviations for Item 27 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: Mathematics teachers believe it is important to have the opportunity to meet with business and university mathematicians on an equal level.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.866	.874	97	4.083	.745
Occasional	117	3.727	.887	117	3.880	.768
Never	9	2.889	1.167	9	3.333	.866
Total	223	3.296	.950	223	3.525	.909

Table 77

Repeated Measures Analysis of Variance for Item 27 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	13.33	6.66	7.22*
Within Cells	220	203.11	0.92	
Within Subjects				
Item 27	1	2.55	2.55	5.62*
Participation Level X Item 27	2	0.40	0.20	0.44
Within Cells	220	99.95	0.45	

*$p < .05$

Responses to Item 30 reflect the shift in participation level between 1986 and 1990. Not only did Frequent participants report that they attend professional meetings organized by mathematics education organizations more that Occasional or Never participants, but they also demonstrated the greatest jump in agreement over time. Since most Occasional and Never participants in 1986 increased in their participation level by 1990, it follows that their ratings on Item 30 should also increase (see Tables 78 and 79 for analyses). These results provide evidence for the reliability and validity of the participation level groupings.

Table 78

Means and Standard Deviations for Item 30 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I regularly attend professional meetings and dinners organized by professional mathematics education organizations at the local level.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.340	1.189	97	4.021	.968
Occasional	116	2.871	1.043	116	2.948	1.037
Never	9	2.333	1.000	9	2.444	1.014
Total	223	3.054	1.136	222	3.396	1.148

Table 79

Repeated Measures Analysis of Variance for Item 30 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	75.83	37.91	23.25*
Within Cells	218	355.55	1.63	
Within Subjects				
Item 30	1	3.02	3.02	4.96*
Participation Level X Item 30	2	9.27	4.64	7.60*
Within Cells	218	132.96	0.61	

*$p < .05$

Results for Item 33 (a reverse item) reveal that, overall, regardless of their participation level, teachers disagree more strongly in 1990 than in 1986 that professional mathematics education organizations do little for the average mathematics teacher (see Tables 80 and 81). Interestingly, there were no group differences, nor was there any participation-level-by-time interaction. Thus, it would appear that even teachers who were Never participants in collaborative activities recognize the effect of the collaboratives on other teachers; see, for example, the Cleveland teacher quoted on page 65. Moreover, the variability in Frequent and Occasional teachers' ratings also decreased over time. This would indicate that not only are these teachers more favorably inclined towards local professional organizations, but they are also less divided in their opinions. Whereas in 1986, about half of the Frequent participants agreed with Item 33, in 1990 only about one third agreed.

Table 80

Means and Standard Deviations for Item 33 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I think that local professional mathematics education organizations do not do much for the average mathematics teacher.[a]

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.072	1.013	97	3.474	.969
Occasional	116	2.940	.963	117	3.248	.899
Never	9	2.444	1.014	9	3.111	1.364
Total	222	2.978	.991	223	3.341	.954

[a] Reverse Item

Table 81

Repeated Measures Analysis of Variance for Item 33[a] by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	5.97	2.99	2.23
Within Cells	219	293.35	1.34	
Within Subjects				
Item 33	1	7.40	7.40	13.83*
Participation Level X Item 33	2	0.60	0.30	0.56
Within Cells	219	117.26	0.54	

*$p < .05$

[a] Reverse Item

Belief in Public Service

Tables 82 and 83 present the descriptive statistics and ANOVA results for the Public Service Scale. As expected, there were overall differences across participation levels, with Frequent and Occasional participants showing higher agreement with the scale than Never participants. Moreover, a significant interaction indicates that both Frequent and Never participants *increased* significantly in their view toward Public Service between the two administrations, while the Occasional participants showed little change. It is unclear exactly why this trend occurred. It may be that the change in the makeup of the 1990 group of Occasional participants, to include more individuals who were Never participants in 1986, may have caused the drop in scores.

One interpretation of these data, when coupled with findings from those who only took the questionnaire in 1990, is that collaboration in and of itself has had little effect on teachers' views regarding Public Service. Rather, it appears that it is what collaboratives do that is more significant in effecting teachers' views on this factor.

Table 82

Means and Standard Deviations for the Public Service Scale for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	95	3.495	.498	94	3.593	.460
Occasional	115	3.503	.520	113	3.477	.495
Never	9	3.048	.704	9	3.238	.631
Total	219	3.481	.524	216	3.517	.491

Table 83

Repeated Measures Analysis of Variance for the Public Service Scale by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	2.61	1.30	3.20*
Within Cells	209	85.11	0.41	
Within Subjects				
Public Service	1	0.28	0.28	2.81
Participation Level X Public Service	2	0.66	0.33	3.29*
Within Cells	209	20.96	0.10	

*$p < .05$

Results for Item 2 (see Tables 84 and 85) also reveal a significant Participation-level-by-time interaction. Again, like the total scale pattern, Frequent and Never participants increased in their agreement that mathematics teachers believe in the social benefits of their work, while Occasional participants decreased slightly. No overall group differences were discovered.

Table 84

Means and Standard Deviations for Item 2 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: Mathematics teachers believe in the social benefits of their work.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	96	3.833	.879	95	4.063	.649
Occasional	117	3.940	.802	117	3.838	.900
Never	9	3.556	.882	9	3.778	.972
Total	222	3.878	.839	221	3.932	.809

Table 85

Repeated Measures Analysis of Variance for Item 2 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	1.33	0.67	0.75
Within Cells	217	191.97	0.88	
Within Subjects				
Item 2	1	0.51	0.51	1.09
Participation Level X Item 2	2	3.27	1.63	3.48*
Within Cells	217	118.59	0.54	

*$p < .05$

With regard to whether mathematics teachers believe that any weakening in teaching of mathematics would be harmful to society (Item 31), results indicate that there was an overall change in agreement from 1986 to 1990 (see Tables 86 and 87). The significant interaction, however, also indicates that this change is located within the Frequent and Never groups. Both Frequent and Never participants increased in their beliefs that mathematics teachers feel that weakening of the profession would be harmful for society, whereas Occasional participants decreased slightly on this item. The largest increase in attitude occurred in the Never group. These teachers increased about one standard deviation in their agreement with Item 31. It is unclear exactly why this occurred. Perhaps the very high ratings for the Frequent and Occasional groups in 1990 created a ceiling effect on the data, or perhaps some outside influence such as the increased emphasis on mathematics education reform has influenced these teachers dramatically.

Table 86

Means and Standard Deviations for Item 31 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: Mathematics teachers believe that any weakening in the teaching of mathematics as a profession would be harmful for society.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	4.165	.672	97	4.330	.554
Occasional	116	4.379	.754	117	4.291	.670
Never	9	3.222	.972	9	4.111	.601
Total	222	4.239	.762	223	4.300	.618

Table 87

Repeated Measures Analysis of Variance for Item 31 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	7.54	3.77	6.16*
Within Cells	219	134.07	0.61	
Within Subjects				
Item 31	1	3.54	3.54	11.72*
Participation Level X Item 31	2	5.02	2.51	8.31*
Within Cells	219	66.10	0.30	

*$p < .05$

Importance of Self-Regulation

Results for the Self-Regulation Scale overall revealed non-significant differences. However, when analyzed item by item, several patterns resulted. For example, teachers rated Item 3 (I believe that professional organizations of mathematics teachers should set the standards and requirements for teaching mathematics) higher, on average, in 1990 than in 1986. This overall trend may be attributable to the pervasive influence of the NCTM *Standards* and other trend-setting documents that were published in the interval between the two administrations of the Survey on Teacher Professionalism. Interestingly, while all three participation levels increased in agreement from 1986 to 1990, the Frequent and Never participants increased more dramatically than the Occasional participants (see Tables 88 and 89).

This analysis indicates little, if any, effects of collaboration in general on Self-Regulation. There is a general increase in teachers' responses towards their own regulation, but this could be accounted for by other factors besides collaborative participation--namely, the quality of the environment that favors educational reform.

Table 88

Means and Standard Deviations for Item 3 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I believe that professional organizations of mathematics teachers should set the standards and requirements for teaching mathematics.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	96	3.813	.955	97	4.113	.888
Occasional	117	3.539	.987	117	3.709	.983
Never	9	3.222	1.093	9	4.000	1.225
Total	222	3.644	.986	223	3.897	.969

Table 89

Repeated Measures Analysis of Variance for Item 3 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	12.26	6.13	5.32*
Within Cells	219	252.35	1.15	
Within Subjects				
Item 3	1	5.91	5.91	8.30*
Participation Level X Item 2	2	1.70	0.85	1.19
Within Cells	219	155.99	0.71	

*$p < .05$

Similarly, agreement that teachers should have more freedom to make decisions about their own work (Item 14) also increased overall between 1986 and 1990 (see Tables 90 and 91). Again, Frequent and Never participants showed a much larger increase than Occasional participants.

Table 90

Means and Standard Deviations for Item 14 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: In my view, mathematics teachers should have more freedom to collectively make decisions about their own work.

	1986			1990		
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.907	.778	96	4.146	.680
Occasional	117	4.068	.763	117	4.051	.680
Never	9	3.556	1.014	9	4.000	.866
Total	223	3.978	.785	222	4.090	.687

Table 91

Repeated Measures Analysis of Variance for Item 14 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	1.35	0.67	0.99
Within Cells	219	148.64	0.68	
Within Subjects				
Item 14	1	1.71	1.71	4.21*
Participation Level X Item 14	2	2.25	1.13	2.78
Within Cells	219	88.84	0.41	

*$p < .05$

Surprisingly, teachers' responses to Item 18 (I believe I have a high level of competence in the subject matter of all high school mathematics courses) *decreased* for all participation levels. Whereas the Frequent and Occasional participants decreased only slightly, Never participants' scores decreased approximately 1 standard deviation (see Tables 92 and 93). This represents a significant participation-level-by-time interaction. These results would indicate that while the collaboratives have reinforced perceptions of level of competence of Frequent and Occasional participants, perhaps through collaborative programming and support groups, Never participants have little recourse for maintaining their feelings of competence, especially with new trends in content and pedagogy requiring a more sophisticated level of knowledge.

Table 92

Means and Standard Deviations for Item 18 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I believe I have a high level of competence in the subject matter of all high school mathematics courses.

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.928	1.102	97	3.907	1.081
Occasional	116	3.991	1.083	117	3.914	1.063
Never	9	3.889	0.928	9	2.889	1.453
Total	222	3.960	1.082	223	3.870	1.101

Table 93

Repeated Measures Analysis of Variance for Item 18 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	5.47	2.74	1.46
Within Cells	219	410.61	1.87	
Within Subjects				
Item 18	1	4.49	4.49	9.44*
Participation Level X Item 18	2	4.00	2.00	4.20*
Within Cells	219	104.27	0.48	

*$p < .05$

Importance of Sense of Calling

Overall, the repeated measures analysis showed no collaborative impact on the Sense of Calling Scale. Only one item on the Sense of Calling Scale showed any significant differences between the 1986 and 1990 administrations of the Survey on Teacher Professionalism. Tables 94 and 95 indicate that overall, teachers felt more strongly in 1990 than in 1986 that professional contacts helped to maintain enthusiasm about teaching mathematics.

Table 94

Means and Standard Deviations for Item 17 for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism: I feel that even with professional contacts, it is difficult to maintain enthusiasm about teaching mathematics.[a]

		1986			1990	
Participation Level	N	Mean	SD	N	Mean	SD
Frequent	97	3.680	1.056	97	3.814	.905
Occasional	117	3.453	1.118	117	3.539	1.022
Never	9	3.333	1.118	9	4.000	.500
Total	223	3.547	1.093	223	3.677	.965

[a]Reverse Item

Table 95

Repeated Measures Analysis of Variance for Item 17 by Participation Level

Source	D.F.	Sum of Squares	Mean Square	F
Between Groups				
Participation Level	2	6.78	3.39	2.21
Within Cells	220	337.62	1.53	
Within Subjects				
Item 17	1	3.02	3.02	5.27*
Participation Level X Item 17	2	1.41	0.71	1.23
Within Cells	220	126.20	0.57	

*$p < .05$

Autonomy

The Repeated Measures ANOVA revealed non-significant differences across participation levels for all items on the Autonomy Scale for the 1986 and 1990 administrations of the Survey of Teacher Professionalism.

Early vs. Late Participants

Although within-subjects analyses reveal interesting patterns in teachers' responses over time, the fact that the make-up of participation levels changed dramatically since the 1986 administration of the Survey makes substantive interpretation of cause and effect difficult. In particular, it is unclear to what extent *change* in participation level over time has influenced teachers' professional attitudes, or vice versa. Moreover, there is some research evidence that would indicate that individuals who participate in the beginning of a project have different attitudinal characteristics than individuals who participate in the later development of the project (Rogers & Shoemaker, 1971). For these reasons, in the remaining section, teachers are classified into the following two categories: those who participated in the early stages of collaborative development, and those who did not initially participate but were influenced to become participants during the four-year interim.

Thus, Frequent and Occasional participants in both administrations were classified as Early Participants (N = 161), and teachers who never participated in the 1986 administration, but who were either Frequent or Occasional participants in the 1990 administration, were classified as Late Participants (N = 53).

Interestingly, *none* of the professionalism scales in the 1990 administration, taken as a whole, showed any significant difference between Early and Late participants. In fact, only six items were found to be rated as significantly different for Early vs. Late participants, and none of the items showed a significant Early/Late vs. Time interaction. This would seem to indicate that the differences found are a function of prior disposition towards collaboration rather than a function of collaborative effect. Thus, it seems that the collaborative project occupies a niche in the professional development arena and can affect Late as well as Early participants in a remarkably similar fashion. Those who eventually become involved in collaborative activity can be affected in their professional attitudes in the same way that those who were there from the beginning were affected.

Most of the differences uncovered for Early vs. Late teachers seem to focus on the perceived utility or value of the collaborative. For example, Items 6 (The collaborative has helped me to develop leadership qualities), 16 (The collaborative has enhanced the professional lives of mathematics teachers), and 48 (The collaborative has expanded my notion of what it means to be a mathematics teacher), were rated significantly higher by Early participants than by Late participants (see Table 96 for Means and Standard Deviations). This is particularly interesting in view of the tendency of early participants to assume ownership of a project, which is more difficult for later participants.

Table 96

Means and Standard Deviations of Early vs. Late Teachers for Items 6, 16, and 48[a]

	Early Teachers			Late Teachers		
Item	N	*M*	*SD*	N	*M*	*SD*
6	160	3.594	0.913	53	3.245	1.054
16	160	4.219	0.706	52	3.923	0.837
48	161	3.938	0.827	53	3.585	0.929

[a] All mean differences significant, $p < .05$.

Three additional items discriminated between Early and Late teachers' attitudes: Items 18 (I believe I have a high level of competence in the subject matter of all high school mathematics courses), 30 (I regularly attend professional meetings and dinners organized by professional mathematics education organizations at the local level), and 42 (Mathematics teachers make decisions about their everyday work). Table 97 presents means and standard deviations for these three items.

Table 97

Means and Standard Deviations of Early vs. Late Teachers for Items 18, 30, and 42[*]

	Early Teachers			Late Teachers		
Item	N	*M*	*SD*	N	*M*	*SD*
18	161	4.019	1.009	53	3.585	1.184
30	160	3.531	1.116	53	3.151	1.167
42	161	4.056	0.637	53	3.868	0.680

[*] All mean differences significant, $p < .05$.

Factor Structure of the Survey of Teacher Professionalism

Due to the differences encountered when examining the reliability of the Survey of Teacher Professionalism Scale for the 1986 administration vs. the 1990 administration, it was determined that a detailed examination of the factor structure of the survey for each administration would uncover areas where teachers showed similar ratings patterns over time. If significant differences in the pattern of teachers' responses were evident, this would be considered evidence of overall change in attitudes that could not be accounted for in a direct investigation of mean differences. In addition, it might uncover areas of inter-item agreement that would suggest that teacher attitudes do not entirely reflect the 5-factor structure of Hall's (1969) theory.

Principal axis factoring uncovered a structure with three factors contributing significant amounts of variance to the total equation for both administrations. Significance was determined, first, by selecting an arbitrary cut-off Eigenvalue of 1.00 and, second, by a scree test (Kim & Mueller, 1978). The unrotated Eigenvalues for the first three factor solutions for both administrations are presented in Table 98.

Table 98

*Eigenvalues and Percent of Variance Accounted For by Extracted Factors for the 1986 and 1990 Administrations of the Survey of Teacher Professionalism**

1986 Administration				1990 Administration			
Factor	Eigenvalue	Pct of Var	Cum Pct	Factor	Eigenvalue	Pct of Var	Cum Pct
1	4.21711	9.8	9.8	1	4.35348	10.1	10.1
2	3.49246	8.1	17.9	2	3.72080	8.7	18.8
3	2.44636	5.7	23.6	3	2.33879	5.4	24.2
4	1.92623	4.5	28.1	4	1.87622	4.4	28.6
5	1.81550	4.2	32.3	5	1.70907	4.0	32.6
6	1.75914	4.1	36.4	6	1.61308	3.8	36.3
7	1.59731	3.7	40.1	7	1.57194	3.7	40.0
8	1.34465	3.1	43.3	8	1.29428	3.0	43.0
9	1.23558	2.9	46.1	9	1.23338	2.9	45.8
10	1.20775	2.8	48.9	10	1.19364	2.8	48.6
11	1.09928	2.6	51.5	11	1.10159	2.6	51.2
12	1.07722	2.5	54.0	12	1.04421	2.4	53.6
13	1.04814	2.4	56.4	13	1.00310	2.3	55.9

*Only Eigenvalues greater than 1.00 are presented.

After the three-factor structure was selected, factors were submitted to Varimax (orthogonal) rotation to simplify interpretation. Only those items whose factor loading (item correlation with the total factor) exceeded ±.30 were considered to contribute significantly to the factor pattern. These correlations are presented in Table 99. It is reasonable that the five original scales developed from Hall's (1969) formulation collapsed into three factors. These five scales were selected to reflect general categories of professional attitudes and were not assumed to be orthogonal to each other. Rather, each attitude category was assumed to interact with the others in significant ways. The results of this factor analysis give us a more detailed look at how these items might interact.

Table 99

Rotated (Varimax) Factor Loadings for the 1986 vs. the 1990 Administrations of the Survey of Teacher Professionalism

	1986 Administration			1990 Administration		
Item	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
1	-.23970	.02599	.03498	.28734	.00316	.02751
2	.24238	-.21618	-.01811	.29577	-.09867	.09756
3	.25150	.03605-	.07531	**.30239**	.13835	.10227
4	.05104	.28626-	.27553	.16483	-.23019	**.45700**
5	**.34487**	-.23242	-.09510	**.46636**	-.13731	-.23817
7	.02901	-.26677	.02233	-.23087	.27458	.18973
8	.23619	.03229	-.08362	-.07606	-.09070	.09264
10	.15399	**-.41771**	.17241	.21141	-.25062	.14440
11	**.35537**	-.11963	.07873	**.43179**	.03713	.07651
12	**.30331**	**.37508**	-.28365	.09788	**.53103**	.15792
14	**.33760**	.29671	-.11807	.24469	**.45792**	.03267
15	.01088	-.03980	.25731	.03017	-.05877	.17606
17	-.07774	**.35016**	-.16575	.23931	-.25724	**.31691**
18	.23679	.09925	-.01926	.11161	.18147	.12842
19	.15470	.11823	.03764	.07348	.21506	-.06589
20	**.38890**	.08423	-.09373	**.33811**	.14529	.06967
21	**.39931**	-.17044	.06090	**.43797**	.00232	.16892
22	.11434	**-.63120**	-.23004	.17655	**-.62064**	.14172
23	.12669	.04325	.02141	-.18704	.00261	.12331
24	**.50419**	**-.30757**	-.05328	**.56284**	.00966	-.05823
25	**.40055**	.04304	.02555	**.30161**	.12339	.26515
27	**.51367**	-.08958	-.10884	**.50508**	.13949	-.04972
28	.07782	**-.55993**	.01981	.15036	**-.51025**	.08361
29	**.36743**	.00843	**.33536**	.26917	.02438	.02483

(Table continues)

Table 99 (continued)

Rotated (Varimax) Factor Loadings for the 1986 vs. the 1990 Administrations of the Survey of Teacher Professionalism

	1986 Administration			1990 Administration		
Item	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
30	**.36671**	-.00629	.18606	**.42870**	.05948	.13579
31	**.46589**	.08876	.21340	**.33019**	.24130	.13963
32	**.37477**	-.01658	.17992	**.40092**	.17817	.10681
33	-.10442	**.41227**	.08726	**.46354**	-.18328	.15558
34	**.30653**	.06562	.19146	.29887	-.02538	-.07018
35	**.33525**	-.02342	.24978	**.40692**	-.12325	-.07477
36	.11094	.22784	**.51812**	-.05953	.08490	.23599
37	.07440	.10673	**.40507**	-.01418	-.01262	**.38462**
38	-.01149	-.21689	**.54858**	-.01009	-.25407	**.31059**
39	.16670	**-.58774**	.10542	.06691	**-.60775**	.10607
40	**.46358**	.01112	.12270	**.43108**	.07391	-.07885
41	.17834	**.32785**	.09316	.05375	**.43202**	-.02548
42	.07751	-.05829	**.55761**	.08193	-.12476	**.55340**
43	-.05960	-.05908	**.37551**	.06789	.20317	.20733
44	**.34464**	-.05704	.05539	.29801	.25627	.20228
45	**.32646**	.20143	.08080	.22953	**.43587**	.19268
46	.24286	.21904	-.02102	.10009	**.47695**	.03984
47	.04049	-.15283	.06429	.06482	-.16738	.14235
49	-.02689	-.14015	.29441	.00732	.02423	**.54104**

Note: Bold entries signify a significant factor loading (Magnitude ≥ .30).

With a three-factor structure, four-item classifications are possible: Items can be classified as contributing to one or more of the three factors, and items can be classified as not contributing to any factor (only 2 of the 43 items on the scale contributed significantly to more than one factor on the 1986 administration, and none of the 43 items had a dual classification in 1990). Thus, if item classifications are tabulated for both administrations, one can determine the degree of similarity between the two administrations by determining the percentage of items showing no change in classification from 1986 to 1990. Of the 45 possible classifications (43 items + 2 doubleton classifications), 29 items, or 64 percent, were consistent. In addition, if one looks only at those items contributing significant variation across both administrations, the percentage of consistent classifications rises to 77 percent (20 out of 26 items). These consistent items are presented in Table 100.

Thus, the items contributing significant variation to the total factor structure are remarkably similar across both administrations. However, the magnitude of the correlations for the 1990 administration appear to be, on the whole, higher than those found in 1986, reflecting the higher internal consistency of the 1990 ratings.

Table 100

Factor Loadings of the Significant Items Classified Consistently Across the 1986 and 1990 Administrations of the Survey of Teacher Professionalism

Item		Factor Loading	
		1986	1990
	Factor 1: Identification with and Dedication to a Reference Group		
5.	Mathematics teachers regularly read journals and publications about mathematics and its applications.	.3449	.4664
11.	Mathematics teachers display dedication to their work.	.3554	.4318
20.	I believe that professional mathematics education organizations at the local level should play a vital role in changing school mathematics.	.3889	.3381
21.	I believe that the time I spend on continued training in mathematics is well spent.	.3993	.4380
24.	Mathematics teachers believe it is important to support professional mathematics education organizations at the local level.	.5042	.5628
25.	I think that the teaching of mathematics is essential to our society.	.4006	.3016
27.	Mathematics teachers feel it is important to have the opportunity to meet with business and university mathematicians on an equal level.	.5137	.5051
30.	I regularly attend professional meetings and dinners organized by professional mathematics education organizations at the local level.	.3667	.4287
31.	Mathematics teachers believe that any weakening in the teaching of mathematics as a profession would be harmful for society.	.4659	.3301
32.	Mathematics teachers think reforms in school mathematics should evolve from and be implemented through the professional mathematics education organizations.	.3748	.4009

(Table continues)

Table 100 (continued)

Factor Loadings of the Significant Items Classified Consistently Across the 1986 and 1990 Administrations of the Survey of Teacher Professionalism

Item		Factor Loading 1986	Factor Loading 1990
	Factor 1: Identification with and Dedication to a Reference Group		
35.	Mathematics teachers hold their own in discussions with business and university mathematicians.	.3353	.4069
40.	Mathematics teachers feel they have an important contribution to make in discussions with business and university mathematicians.	.4636	.4311
	Factor 2: Perceived Worth of Contribution by Others		
12.	Mathematics teachers think too much control over their work is exercised by people who lack mathematical expertise.	.3751	.5310
22.[a]	I believe my work as a mathematics teacher is not appreciated by most people.	-.6312	-.6206
28.[a]	Mathematics teachers feel that their contribution to society is not recognized by business and university mathematicians.	-.5599	-.5103
39.[a]	Mathematics teachers feel that the public does not realize the contribution that mathematics teachers make to society.	-.5877	-.6078
41.	Mathematics teachers think they should be evaluated only by other mathematics teachers.	.3279	.4320
	Factor 3: Autonomy in the Classroom		
37.	In practice, mathematics teachers are the ones who determine what is actually taught in the courses they teach.	.4051	.3846
38.	Mathematics teachers believe they have the control that they should have over their everyday work.	.5486	.3106
42.	Mathematics teachers make decisions about their everyday work.	.5576	.5534

[a] Reverse Item

These three factors display generally higher internal consistency (alpha = .72 for Factor 1, .69 for Factor 2, and .47 for Factor 3) than the five original scales. In addition, they represent a more parsimonious framework with which to describe teachers' beliefs about their profession--and one that is consistent with the literature. In examining the items classified within each factor, we can begin to understand the often conflicting nature of what it means to be a member of the mathematics teaching profession.

Factor 1 contains items pertaining to teachers' identification with the profession of mathematics teaching, including their beliefs regarding the importance of the profession and their dedication and commitment. In general, teachers scoring high on this factor believe strongly in the importance of mathematics teaching, and they believe in the importance of mathematics education organizations in advancing reform efforts. Moreover, they feel they have an important contribution (a feeling of self-worth) to make in discussions with mathematicians from other professions.

Factor 2 contains items that seem to conflict with teachers' strong sense of their profession. Items in Factor 2 tend to focus on the lack of recognition teachers receive for their efforts, both from the public and from other mathematicians. In addition, two items deal with the control exerted over their work by "outsiders" and the role of outsiders in evaluating their work.

Factor 3 focuses on the autonomy teachers have in their classrooms. Teachers scoring high on this factor feel that they do make decisions regarding their everyday work and that they have some control over what is taught in their classes.

Combining the above patterns, we can begin to see some of the influences affecting collaborative teachers in determining their professional attitudes. Whereas they have a strong sense of the importance of their work, they believe that others, namely the public, do not recognize or value the contribution they make to society. Further, although they have control within their own classrooms, evaluation from outside sources--often from individuals who do not share their sense of mathematics, or their commitment to mathematics teaching--may lead to ill feelings and lower professional self-esteem. Thus, it seems that professional autonomy is an issue that may be multifaceted. Teachers may have a great deal of autonomy within certain restricted bounds (i.e., the classroom, or the building), but may have less ultimate autonomy when it comes to evaluating their work.

IV. DISCUSSION

On scrutinizing the information presented in the Results section of this paper, we can come to some general conclusions regarding mathematics teachers' attitudes towards their profession and how these attitudes interrelate and change over time. Conducting the study in the context of the current reform movement in mathematics education has been both problematic and facilitative in interpreting the findings. It has been problematic in that it is difficult to isolate the specific effects the collaborative project has had on the development of teachers' professional attitudes due to the pervasiveness of influences like the NCTM *Standards* and their impact on rhetoric, policy, and practice. It has been facilitative in that the study provides information on the intellectual milieu in which the collaboratives have flourished, and it addresses a cause embraced by the collaboratives behind which teachers could rally. In addition, the success of the collaboratives in attracting new members over the years has provided powerful evidence of their impact on the mathematics teaching community. Yet, these dynamics have changed the nature of the collaboratives as new members became more active and influential. This has also proved problematic with respect to specific conclusions regarding the effects of collaboration on teacher attitudes.

However, regardless of these difficulties, there are commonalities in the data that enable Documentation Project staff to make fairly definitive statements regarding the professional attitudes of participating teachers. In general, the results of this longitudinal study reveal the often conflicting values held by teachers of mathematics regarding the nature of their profession, its contribution to society, and its perceived value in the society it serves.

> The data for the Surveys of Teacher Professionalism indicate conclusively that:
>
> The collaboratives have increased the number and types of professional activities available to teachers and have expanded the professional reference group of teachers to include individuals from business and higher education.
>
> Collaboration in and of itself is not uniformly effective. However, what the collaboratives do has differential effects on teachers' attitudes. Collaboratives that have focused on interacting with business and higher education have facilitated the comfort level their member teachers feel with members of these related groups, as evidenced by results on the Public Service Scale.

> Regional and local conditions are critical factors, interacting with many of the dimensions of professionalism, and facilitating or hindering the positive development of professional attitudes. In particular, teachers views of Autonomy were stronger in the direction of making their own decisions in the California collaboratives and weaker in the southern collaboratives.
>
> The original model of professionalism with five attributes, although useful and descriptive, did not hold up well when subjected to statistical scrutiny. Teachers' responses indicate three major dimensions of professionalism: Identification with and Dedication to a Reference Group; Perceived Worth of Contribution by Others; and Autonomy in the Classroom. These factors seemed to be relatively stable over time.

Teachers in general seem to hold a positive view toward each of the five attributes of professional attitudes defined by Hall (1968; 1969). They look toward professional organizations as vehicles for developing their profession and implementing reform. They believe that they contribute significantly to society by providing a literate workforce, capable of informed problem-solving, and mathematically sophisticated consumers. They believe that they should have more say in the evaluation of their peers since they possess the specialized knowledge necessary for making accurate assessment; yet they also believe that others such as university educators and school administrators should be a part of a collaborative evaluation team. They feel a fairly strong sense of calling, but not to the extent that they would continue teaching if faced with a salary reduction. Lastly, teachers believe that they should have increased autonomy both in the classroom and in determining the content and curriculum choices for their students and districts. For the most part, the attitudes of teachers on all of these measures improved between the 1986 and the 1990 administrations of the Survey of Teacher Professionalism.

Teachers' responses to these items point out the discrepancy between ideals and beliefs about the importance of their work and the reality of teaching in a bureaucratic structure that provides little autonomy and recognition. They believe that too much control is exercised over their work by persons who are not teachers; they also are of the opinion that the society they serve, and even other members of the mathematics community, do not recognize the important contribution that school mathematics teachers make to society. The only place where mathematics teachers exert autonomy over their work is in the classroom. Whereas they have little control over the choice of texts and the mathematical content to be included in classroom activities, teachers reported that they in fact determine what actually gets taught in their classes and that they do make decisions regarding their everyday work.

In addition to these more general findings, the results of this study indicate that teachers' attitudes varied on the basis of their levels of participation in collaborative activities. As would be expected, collaborative participants (both Occasional and Frequent) believe more strongly in the importance of local professional mathematics education organizations than do non-participants. The magnitude and direction of change in teachers' responses indicate that the strengths of these beliefs are direct functions of their level of participation in the collaborative. While it is unclear whether the collaboratives have changed teachers' beliefs regarding professional organizations, or whether the participants are those teachers already predisposed to engage in activities that would extend their professional horizons, it is clear from the data that the local collaboratives have provided an atmosphere conducive to professional development and have encouraged participation in professional organizations.

Consistent with their beliefs regarding professional organizations, mathematics teachers are somewhat cynical about others (non-mathematics professionals) making decisions regarding mathematics education, particularly in the evaluation of mathematics teaching. Rather, they feel that standards should be set by professional organizations of mathematics teachers in collaboration with other members of the mathematics education community. This belief is held more strongly by Frequent collaborative participants than by either Occasional or Never participants.

In addition, collaborative participants believe in continued training in mathematics and mathematics teaching to a greater extent than those who never participated in the collaboratives. These findings are consistent with demographic data from the Secondary Mathematics Teacher Questionnaire that indicate that collaborative teachers engage in more professional training/higher education opportunities than a national sample of teachers (Middleton et al., 1989). This trend may be due, in part, to the financial support and inservice opportunities that the collaboratives have provided. While it is clear that the local collaboratives have provided opportunities that teachers would not have otherwise, some teachers still feel that the collaboratives should provide more financial support for professional development.

Just what is the impact of the UMC project on informing teachers' professional attitudes? We examined the data from both administrations of the Survey of Teacher Professionalism with particular attention to this issue. As stated above, the coincidence of the national concern with educational reform and the establishment of the UMC project makes separation of the two events impossible. The UMC project embraced the tenets of mathematics education reform and teacher empowerment and became a powerful advocate of the reform movement. Thus, any conclusions made from the data must be examined in light of this reciprocity. In short, whether or not the UMC project alone has effected change in teachers' attitudes directly is a moot question. The fact is, the collaboratives have provided a forum for discussion about mathematics and mathematics education, support for professional training and participation in professional meetings, and encouragement for teachers to interact with other members of their profession. In many cases, the local collaboratives may be the primary, if not the only, forum that supports such interaction.

Teachers participating in the survey tended to attribute the change in their professional attitudes and opportunities to the influence of the local collaboratives. In terms of these teachers' beliefs, the collaboratives have increased teachers' leadership potential, increased teachers' attention to equity, and increased their commitment to equity issues. Moreover, teachers believed strongly that the collaboratives have enhanced the professional lives of mathematics teachers. This is particularly informative in that even the Never participants were in agreement that the collaboratives are a positive influence on teachers' lives.

Although the point has been made earlier in this paper and elsewhere, it bears repeating: The best evidence we have regarding the impact of the UMC project on the mathematics teaching community in our nations' urban centers is the dramatic increase in the number of teachers becoming active participants. On the macro-level, the number of collaboratives established since the start of the project has increased from five to fifteen. On the middle-level, the number of teachers at each site becoming collaborative members has increased dramatically. And on the micro-level, the results of this paper show that once teachers join the collaboratives, they tend to remain members, presumably for the reasons cited above.

In closing, we must state the facts regarding the conditions that affect mathematics teachers' professionalism and make a determination as to whether mathematics teachers can identify as professionals:

(1) The present results indicate that teachers do possess attitudes reflective of professional thinking.

(2) Our results indicate that these attitudes are influenced by participation in a professional organization: the local collaborative.

(3) The teachers who responded expressed a desire for self-improvement and professional development.

Thus, it seems reasonable to assume that these teachers are, in fact, professionals.

However, professional attitudes are only one aspect of the making of a professional. These attitudes can flourish only in a supportive atmosphere. Thus, the structure and the status of the profession can facilitate or inhibit professional attitudes. Unfortunately, despite their enthusiasm, participating teachers also revealed their belief that their profession lacks autonomy and prestige. It seems that teachers still have a long way to go. Several teachers, responding to the Diary of Professional Relationships, revealed a desire for the local collaboratives to become more influential in increasing professional autonomy.

Although it is unclear what the role of the collaboratives will be in the future, one thing is apparent: The collaboratives have made a place for themselves as influential institutions within the mathematics education reform movement and have impacted on the professional lives of their members, and on the local districts in general. It can only be hoped that their influence will continue to grow such that a steadily increasing number of urban mathematics teachers will be affected.

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Appendix A

Survey of Teacher Professionalism

UMC Documentation Project
University of Wisconsin-Madison

Date ____________________________________
(month) (day) (year)

TEACHER SURVEY IV

Please fill in today's date in the upper right hand corner. In the spaces provided below, write your name, school, city, state, courses now teaching and the grade level(s) of the students. Then indicate your level of participation in the collaborative by circling how often you participate in collaborative activities.

Name ____________________________________
(first) (last)

School ____________________________________

City, State ____________________________________

Title of Course(s) Currently Teaching	Grade Level(s)

Level of Participation in the collaborative:

Circle One: Never Occasionally Frequently

Answer the questions on both sides of the following pages. Then return the completed questionnaire to the designated person in the envelope provided. Please seal the envelope and print your name on the outside. (The envelope will not be opened until it reaches the UMC Documentation Project at the University of Wisconsin.)

All responses will be strictly confidential. Only summary information will be shared.

THANK YOU FOR YOUR COOPERATION IN COMPLETING THIS SURVEY.

Instructions

The following questions are designed to gather information about the impressions of high school mathematics teachers regarding a variety of issues. Some items should be answered in light of the way you personally feel and behave as a high school mathematics teacher, while other items ask your perceptions of how mathematics teachers in general feel and behave.

There are five possible responses to each item. If you STRONGLY AGREE with the statement, in that it corresponds to your own attitudes or behavior, or to your impression of the attitudes or behavior of mathematics teachers in general, circle that response. Similarly, if you AGREE, DISAGREE, or STRONGLY DISAGREE with the statement, mark the appropriate response. The middle category, NEUTRAL, is designed to indicate that you have no opinion about the statement. Please answer all items, making sure that you have circled only ONE response for each item.

Circle the most appropriate response.

1. I feel out of place meeting with mathematicians from businesses and universities.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGREE

2. Mathematics teachers believe in the social benefits of their work.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGRE

3. I believe that professional organizations of mathematics teachers should set the standards and requirements for teaching mathematics.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGRE

4. I don't have the opportunity to exercise my own judgement in my work.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGRE

5. Mathematics teachers regularly read journals and publications about mathematics and its applications.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGRE

6. The collaborative has helped me to develop leadership qualities.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGRE

7. Mathematics teachers believe parents are in a good position to judge how well mathematics is taught in their children's schools.

STRONGLY AGREE | AGREE | NEUTRAL | DISAGREE | STRONGLY DISAGRE

(Please turn the page.)

8. Mathematics teachers think that it is more important to receive continued training in mathematics than it is to receive training in effective ways to teach and manage mathematics classes.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

9. Mathematics teachers have a major responsibility to ensure that all students have equal opportunity to learn mathematics.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

10. I think that the importance of teaching high school mathematics is widely recognized by others.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

11. Mathematics teachers display dedication to their work.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

12. Mathematics teachers think too much control over their work is exercised by people who lack mathematical expertise.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

13. The collaborative has raised my awareness of equity issues concerning school mathematics.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

14. In my view, mathematics teachers should have more freedom to collectively make decisions about their own work.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

(Please turn the page.)

15. I think of myself first as a teacher, then as a mathematician.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

16. The collaborative has enhanced the professional lives of mathematics teachers.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

17. I feel that even with professional contacts, it is difficult to maintain enthusiasm about teaching mathematics.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

18. I believe I have a high level of competence in the subject matter of all high school mathematics courses.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE

19. I believe that the final decision on the content of mathematics instruction should be made by individual mathematics teachers.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

20. I believe that professional mathematics education organizations at the local level should play a vital role in changing school mathematics.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

21. I believe that time I spend on continued training in mathematics is well spent.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

(Please turn the page.)

22. I believe my work as a mathematics teacher is not appreciated by most people.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

23. Decisions I make in my daily work should be subject to review by the chair of our mathematics department.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

24. Mathematics teachers believe it is important to support professional mathematics education organizations at the local level.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

25. I think that the teaching of mathematics is essential in our society.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

26. The collaborative has contributed to teachers assuming leadership roles.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

27. Mathematics teachers feel it is important to have the opportunity to meet with business and university mathematicians on an equal level.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE

28. Mathematics teachers feel that their contribution to society is not recognized by business and university mathematicians.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

(Please turn the page.)

29. Mathematics teachers are teachers primarily because they enjoy working with young people.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

30. I regularly attend professional meetings and dinners organized by professional mathematics education organizations at the local level.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

31. Mathematics teachers believe that any weakening in the teaching of mathematics as a profession would be harmful for society.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

32. Mathematics teachers think reforms in school mathematics should evolve from and be implemented through the professional mathematics education organizations.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

33. I think that local professional mathematics education organizations do not do much for the average mathematics teacher.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

34. Mathematics teachers in my school are able to judge how well our mathematics department is doing.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

35. Mathematics teachers hold their own in discussions with business and university mathematicians.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

(Please turn the page.)

36. Mathematics teachers consider themselves as teachers more so than as mathematicians.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

37. In practice, mathematics teachers are the ones who determine what is actually taught in the courses they teach.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

38. Mathematics teachers believe they have the control that they should have over their everyday work.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

39. Mathematics teachers feel that the public does not realize the contribution that mathematics teachers make to society.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

40. Mathematics teachers feel they have an important contribution to make in discussions with business and university mathematicians.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

41. Mathematics teachers think that they should be evaluated only by other mathematics teachers.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

42. Mathematics teachers make decisions about their everyday work.

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGRE

(Please turn the page.)

43. I think district administrators should have the final responsibility for what is taught in school mathematics.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGRE

44. I teach because I enjoy mathematics.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGRE

45. Mathematics teachers are the most appropriate people to make decisions about methods of mathematics instruction.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGRE

46. I believe that because of the degree of specialized knowledge required in teaching mathematics, only mathematics teachers are competent to judge how well other mathematics teachers do their work.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGRE

47. I would stay in the teaching of mathematics even if my salary were reduced.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGRE

48. The collaborative has expanded my notion of what it means to be a mathematics teacher.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGRE

49. I make my own decisions in regard to my everyday work.

STRONGLY				STRONGLY
AGREE	AGREE	NEUTRAL	DISAGREE	DISAGREE

THANK YOU!

This is the final written survey that you will be asked to complete for the UMC Documentation Project. We greatly appreciate your time and effort in helping us gather the necessary information to document the development of the Urban Mathematics Collaborative Project. The information that you have shared with us will not only help us to better understand the UMC Project, but will assist others in their efforts to document similar projects in the future.

Appendix B

Teachers' Responses to The Diary of Professional Relationships

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Table B1. *Teachers' Responses to the Diary of Professional Relationships*

"What role do mathematics organizations play in improving mathematics instruction?"

Cleveland

They give teachers a place to present ideas that they have used in the classroom for other teachers. This will promote better mathematics education.

Place for sharing ideas, presenting new concepts for teaching and to prepare students for work by giving examples of what is necessary to function in society.

Keep you up-to-date with changes, new ideas, new methods, and articles written by different people.

Collect ideas and present new ideas to a local group.

They provide an opportunity to get together with other math teachers to discuss current trends in mathematics that will affect your classroom.

Durham

They support teachers professionally and the area of mathematics instruction. They provide a "bully pulpit" for new ideas and for teacher empowerment. They encourage us to study and broaden our knowledge of mathematics.

They maintain teacher perspective on course content. They take the blinders off of classroom teachers.

I have gotten valuable information, worksheets, etc. from NCTM's *Mathematics Teacher*. They keep us up to date on methods and content.

They provide the classroom teacher with news of advancements in both methods and topics and research.

They play an important role with meetings and workshops from which teachers can take back ideas to their schools. They keep us up to date with new ideas and they reinforce the concepts about teaching mathematics when appropriate.

They provide a place to exchange ideas among teachers. They provide publications which give ideas on teaching math. They provide a way to begin setting national standards for mathematics education.

Los Angeles

By and large they are the vehicle for determining ideas.

Exposes you to other teachers and resources. Opens communication with other teachers you would normally not speak to.

Table B1 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do mathematics organizations play in improving mathematics instruction?"

Los Angeles

Grassroots role. They organize not the elite but the majority. Majority of concerns are brought up, not just elite's group.

They offer workshops and conferences.

Staff development, networking, dissemination of information.

Memphis

They help teachers keep abreast of new developments in mathematics teaching. They provide opportunities for teachers to share their techniques, successes, and failures.

Math organizations keep teachers abreast of the latest trends in math education in order to keep American students competitive with other technological nations.

Math organizations keep teachers abreast of new ideas, approaches, and unique instruction techniques. They serve as informers of the latest trends.

Math organizations give ideas that help teachers to be creative, vary strategies, and update curriculum.

I think math organizations are the movers and shakers of math reform. They inform teachers what must be changed in order to keep up with an ever-changing technological world. Math organizations give teachers a direction; they keep us updated with new techniques for presenting concepts.

Philadelphia

As much as the teacher will allow! "Papers" and meetings can be a great help.

Math organizations play a very significant role. They raise the levels of professionalism, expectation, and awareness of new trends.

Mathematics organizations facilitate the latest "goings-on" in the math field being told to the teachers. This then makes an impact on the classroom instruction.

They should provide teachers with new methods to teach subject matter. What works--what doesn't.

Definitely not proportionally to energy expended by collaborative.

They offer up-to-date thinking about math teaching to those who make an effort to attend conferences, etc.

Table B1 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do mathematics organizations play in improving mathematics instruction?"

Philadelphia

Guidance, instructional form and cohesive unit among colleagues.

They set goals, establish dialogue, set standards, define and design staff development, provide a forum for sharing on many levels, lobby for support and/or change.

Provide a vehicle for instruction of curriculum issues, give an opportunity to share ideas, and provide inservice opportunities for instructional improvement.

Pittsburgh

Give latest up-to-date materials. Obtain information on calculators.

Math organizations aware of changes in the field. What goes on in other parts of the country. Compare with others in the nation.

NCTM conventions--keep up-to-date. She can do math (goes to higher seminars) [Time off] Also teaching ideas obtained.

Place for exchange of ideas, as at conventions.

NCTM *Standards*. Change and recommend changes. Now have . . .

San Diego

Mathematics organizations provide teachers who participate with the latest techniques on how to teach mathematics and to updated content.

They offer workshops, seminars. Magazines have new ideas; problems which can be used in classes. Meet people. . . . other teachers, university professors, etc.

A great role because new ideas diffuse through the community. They disseminate information. They allow us to network.

Sponsors of conferences like NCTM conference. Newsletters, communication is helpful. Organizing people of like minds.

San Francisco

They provide an opportunity for education, to learn more math to share with others at my school site. They form a network for teachers to work together, share ideas across grade levels.

Table B1 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do mathematics organizations play in improving mathematics instruction?"

San Francisco

They provide a way to communicate new ideas, different applications, different "tricks of the trade."

They have seminars and workshops.

They offer a social and professional forum. They offer activities to bring teachers together to get to know each other and to share ideas and find out what's happening. Also, an organization like NCTM can be a forum for teaching ideas through their journals and conferences, and by coming out with things like the *Standards*.

They make teachers aware of issues in math education by having workshops and putting out newsletters. They can also get teachers involved politically in having a say in what the district wants to do.

St. Louis

Math organizations improve instruction:
(1) Offer an opportunity to share information with peers
(2) Offer an opportunity to learn about innovative ideas
(3) Keep me abreast of new trends in instruction.

Informs one of that which is current; curriculum and methods can be altered, created or extended within current school year.

Introduction of new ideas, concepts and activities; updating curriculum; exposure, sharing and improving instruction; professional growth/improvement.

Keeps teachers abreast of current trends; affords teachers opportunity to share ideas, strategies, etc.; affords teachers opportunities to work together on various projects.

Setting of goals; disseminating of research; serving as an information center;
a forum for exchange of ideas and concepts; bring people together for interchange, instruction, etc.

Keep teachers up to date on new information, methods, technology, ideas, etc.;
have speakers come in to uplift teachers with their innovations, ideas, and programs;
send people to seminars and classes for self improvement.

Table B1 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do mathematics organizations play in improving mathematics instruction?"

Twin Cities

> Their voice represents the majority of the mathematics teaching community. Therefore, those constituencies affected by those organizations will take notice.
>
> Providing contact with current issues and trends. Supporting teachers in the difficult task of teaching.
>
> Increases opportunities for networking. Makes available information on new ideas, new curriculum, and a variety of conferences and workshops that are worthwhile.
>
> I believe they open doors for math teachers in showing new issues, new topics, new methods. However, not all math teachers choose to walk through these doors.
>
> The organizations improve the communication between the real world and the educational system.

Table B2. *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics organizations play?"

Cleveland

To develop better standards and curriculum to go along with the *Standards* (K-12) and implementation of technology in the curriculum.

To help us improve professionally, to give us incentive to improve our teaching skills.

Their role is quite satisfactory.

Analyze and discuss the feasibility of adopting area wide a locally successful program. Provide funds for investigation.

They should start changing the way mathematics is looked at by the school boards or the administrations. They should be made to realize that taking mathematics is more than just passing standardized tests.

Durham

I feel that NCTM and NCCTM pretty much play the role that they should as described above. They could do more in the area of professional support, i.e., salaries and working conditions.

A role much as described above. Keep us aware of what is useful and current.

They should keep all mathematics teachers informed about the latest trends in mathematics education.

They should promote interaction among teachers, should provide a forum for sharing ideas, should encourage teachers to capitalize on opportunities. They should keep teachers abreast of tried and true material.

They should play the role that they do but in addition they should offer some funding--e.g., NCCTM has had me do workshops at some meetings, but I must pay my own expenses unless I can get a grant from some other source.

That which they now play as described in 1a: provide a place to exchange ideas, provide publications, begin setting national standards for mathematics education.

Los Angeles

That's the role they will have to play (as a vehicle for determining ideas). They will leave it to teachers to seek further guidance. A resource base.

I'd like them to turn me on to things that have been successful like software. Anything they can do to support me in the classroom.

Table B2 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics organizations play?"

Los Angeles

Facilitator. One that provides means and ways for the group to enhance math instruction in class and professional development and growth--professional development and growth to improve their classroom.

They should be there discussing issues which affect teachers every day like instructional techniques, latest technology, etc.

All of the above (1a., staff development, networking, dissemination of information) plus more, say in the classroom curriculum.

Memphis

That is the role they should play (help teachers keep abreast of new developments, provide opportunities for the sharing of techniques, successes, and failures).

They should determine the direction that math education should go in the future.

They should do as I mentioned in part (a): keep teachers abreast of new ideas, approaches, and unique instructional techniques; serve as informers of the latest trends.

Same as (a): give ideas that help teachers be creative, vary strategies, and update curriculum.

Same as (a): as the movers and shakers of math reform, they inform teachers what must be changed; give teachers direction, keep us updated with new techniques . . . .Also, they should be the spokesmen for math teachers and their needs. They need to lobby to get updated classrooms with modern technology to aid in math education.

Philadelphia

They should be a constant support and resource.

Those mentioned above (raise the level of professionalism, expectation, and awareness of new trends).

To continue to be a resource for teachers.

Information banks.

They should do more to bring their many services into the schools for teachers who will not or cannot go where the services are.

Should play the role of leadership.

Table B2 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics organizations play?"

Philadelphia

All these: set goals and standards, establish dialogue, define and design staff development, provide a forum for sharing, lobby for support and/or change.

These [1a.]: Provide a vehicle for discussion of curriculum issues, give an opportunity to share ideas and provide inservice opportunities . . . and possibly more opportunities for exchange of ideas and techniques.

Pittsburgh

What they are doing.

That is the biggest: Being able to communicate with teachers in other parts of the country.

Need organization to drive/organize change; eg., *Standards*, calculators.

Periodicals could be more in tune with classroom, rather than esoteric (e.g., fractals).

Need to take a more active role in preparing math teachers in the future. Promoting mathematics teachers. Getting college involved in teacher education.

San Diego

They should assist teachers in improving their skills.

Things I have seen them do, they should do. New textbooks, tests, etc.

Locally we have to give each other support on a regular basis.

I think they should sponsor conferences and do things I mentioned earlier (sponsor conferences, newsletters, communication, organize people of like minds).

San Francisco

That's the role they should play (provide opportunity for education, learn more math, form a network to share ideas across grade levels).

They do what they should do, but they should be more available. You have to go after them.

I don't know.

I guess they could be more active. I'd like to see organizations have more say in things like curriculum and textbook selection.

Table B2 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics organizations play?"

San Francisco

That's the role they should play (make teachers aware of issues. . . by having workshops and putting out newsletters; . . . get teachers involved politically in having a say in what the district wants to do). I mean, I think they have to be independent of the bureaucracy. Influence it without becoming it.

St. Louis

They should play all of the above (offer opportunity to share information with peers, to learn about innovative ideas, keep abreast of new trends in instruction), as well as be provocative enough to cause you to change and/or think.

Support well-being of the profession and the professionals. Lend immediate role-models to inspire work in the work place.

Organize, introduce, exposure, and share, update, and assist in professional instruction.

Input in selection of textbooks; liaison between business community and schools--to ensure schools are teaching math skills necessary for success in the business world.

All of the above to varying degrees (setting of goals, disseminating of research, serving as an information center, a forum of exchange of ideas and concepts, bring people together for interchange, instruction, etc).

See above (keeping teachers up to date on new information, methods, technology, ideas; have speakers to uplift teachers with their innovative ideas and programs; send people to seminars and classes for self-improvement).

Twin Cities

They should state their views while fielding the opinions of communities, corporations, etc., and communicate this.

Setting trends, providing inservice training and support through networking.

I like the role now played, but would like more involvement by business so we can exchange information on the needs of each (schools and business).

The same role they are currently doing.

They should provide the link through collaboratives and partnerships.

Table B3. Teachers' *Responses to the Diary of Professional Relationships*

"Are you a member of any professional organizations? (Please List)"

Cleveland

OCTM, NCTM, GCCTM.

Yes. GCCTM, OCTM, NCTM.

No. I used to. NCTM, OCTM, CCTM.

Yes. GCCTM, OCTM, NCTM.

Durham

Yes. NCTM, NCCTM.

Yes. NCCTM and DMC of course.

Yes. NCTM and MAA.

Yes. DCEA, NEA, and DMC.

Yes, NCCTM, NCTM, NCEA, NEA.

NCTM, NCCTM, DMC.

Los Angeles

NCTM, LACTMA, CMC.

NCTM, LAEP.

LACTMA, CUE, ACCA, Phi Delta Kappa.

NCTM, CMC, LACTMA.

NCTM, CMC.

Memphis

National Council of Teachers of Mathematics.
Memphis Urban Mathematics Collaborative.

MUMC and NCTM.

MUMC, NCTM, NEA, TMTA (Tennessee Math Teachers Association), MAC-O-TOM (Memphis Area Council of Teachers of Mathematics).

Table B3 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Are you a member of any professional organizations? (Please List)"

Memphis

MUMC, NCTM, MAC-O-TOM.

Philadelphia

MCTM, ATMOPAV.

MCTM, ATMOPAV.

ATMOPAV, PCTM, NCTM, PCSM, NCSM, ASCD.

NCTM.

NCTM, ATMOPAV.

NCTM, ATMOPAV.

NCTM, NSTA, AAAS.

MAA, NCTM, NCSM, PCTM, PCSM, ATMOPAV, POK.

ATMOPAV, PCTM, NCTM, PCSM, ASCO, PASCO.

Pittsburgh

NCTM, (STAMP) Program.

NCTM.

NCTM, (Was Phi Lambda Theta).

Husband: NCTM.

NCTM, PCTM, ACTE--Future Educators.

San Diego

NCTM, GSDMC.

GSDMC (Greater San Diego Math Council). CMC-SS (California Math Council-Southern Section).

NCTM only.

Table B3 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Are you a member of any professional organizations? (Please List)"

San Diego

NCTM, GSDMC.

San Francisco

San Francisco Math Teachers Association (SFMTA), SF Math TEAM, Collaborative Council, American Society of Curriculum and Development (ASCD), California Math Council (CMC), United Educators of San Francisco (UESF/AFT), Northwest Learning Styles Network.

NCTM, CMC, SF Math TEAM, Women in Math Education, United Educators of San Francisco (UESF/AFT).

San Francisco Math Teachers Association (SFMTA), United Educators of San Francisco (UESF/AFT).

San Francisco Math Teachers Association (SFMTA), California Math Council (CMC), NCTM, UESF/AFT.

San Francisco Math Teachers Association (SFMTA), California Math Council (CMC), NCTM.

St. Louis

Math Collaborative, NCTM.

(None Listed.)

Collaborative NCTM.

NCTM.

NCTM, MCTM, MEGSL, MSTA.

Not this year.

Table B3 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Are you a member of any professional organizations? (Please List)"
Twin Cities
Yes, MCTM, TCUMC, Professional Leadership Organization.
NCTM, MCTM, MMC, TCUMC, MFT.
NCTM, MCTM, Mpls. Math Club.
NCTM, MCTM, Mpls. Math Club.
MCTM, TCUMC, Mini Apples.

Table B4. *Teachers' Responses to the Diary of Professional Relationships*

"What impact should mathematics teachers have on determining the basic content that is taught in their mathematics courses?"

Cleveland

We should have more choice in what is covered, a great impact on curriculum. General topics can be given, but I will choose the rest.

Should be able to teach what is best to prepare the students for the future. Teachers should pick up information to then make content decisions.

A great one on the local level.

Teachers with ten or more years should be active in writing the syllabus and constructing tests.

Better than 50%. Teachers should decide on half the material to be covered and a fourth from the students. One fourth can come from outside the classroom.

Durham

Teachers should have a great deal of input into the content of mathematics courses, not only the ones they teach but the ones that come in the sequence prior to their courses. Perhaps they will not make all of the decisions but they should be heard and heeded.

Much in terms of enrichment and emphasis. Who knows better than ourselves what our students need?

Mathematics teachers should have a major role in determining course content. I mean those who are in the middle and high schools, not college professors.

Teachers should determine the basic content within guide lines provided by experienced mathematics educators. We should have much more of a voice than we presently do.

Not 100%, perhaps 75% or more. The content should be determined by experienced teachers. New teachers need some oversight by others. If there was complete autonomy all would go his/her own way which would cause big problems.

Teachers should have a large impact on what is taught because they are the ones who actually work with the students, know what the students need, and know what information students can cognitively accept.

Table B4 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact should mathematics teachers have on determining the basic content that is taught in their mathematics courses?"

Los Angeles

Teachers need to be the basis of that decision. It should be in committee form so there will be continuity.

We have too much control; I would like to see more standardization. You'd like more say so but we need standards.

I'm confined in LAUSD. The role should be--I don't think a teacher should define content. Content should come from knowledgeable people. Teachers teach what they are told to teach by teacher advisors and organizations. Some teachers don't know what content is. Most are learning math themselves. They would rip the system apart--minimal involvement.

They should fully understand everything or they will have a tough time implementing it (curriculum).

95% cite what the goals of each course, methods used and time allotted [should be].

Memphis

Mathematics teachers should be the ones to determine the content. The teachers are the ones that attend different meetings on current trends in mathematics and they should have enough freedom professionally to try some of the ideas they see.

Math teachers should be represented when decisions on content are made for the school or the school system.

Math teachers should have a great deal of impact on deciding what should be taught in math courses because they know the children and they know what students need. The current curriculum is developed by those out of the classroom too long. Teachers should be the primary leaders in writing curriculum.

Teachers should provide the majority of impact in deciding the content that is to be taught. I think it is good to have an administration-oriented curriculum but not so mandated as it often is now.

Math teachers should be the main decisions makers on what content should be covered in their classes. They know the type of student they face daily. They should be allowed to evaluate and offer changes to the curriculum each year instead of every textbook adoption year (every six years in MCS).

Table B4 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact should mathematics teachers have on determining the basic content that is taught in their mathematics courses?"

Philadelphia

They should, at least, participate in the curriculum writing of the courses.

Teachers should be able to make adjustments in curriculum to fit the individual needs of their students.

Major impact IF they are well-informed on the up to date curricular matters.

Teachers are usually too busy teaching. Representations of our group should meet, however, to discuss the "what" of our curriculum.

More pay than they have now.

98%.

I don't trust math teachers. They will get away with doing nothing unless there is leadership checking.

Collaborative input but not veto. Standards should be established in the larger professional community and then individuals should hew to the line.

Within general parameters as set down by professional organizations or curricular offices, they should have a great deal of freedom in both content and technique.

Pittsburgh

All the impact.

Teachers should have 90% (minimum) of the content.

Should have a lot of impact.
Curriculum District Wide: keeps teachers on task more (especially here in a Vocational School where kids go back to home school), BUT in Algebra I (really dropout prevention in school) struggle to keep up but cannot keep ahead.

Teachers should make the impact, select curriculum, set book, give support. City-wide curriculum, but schools serve different student populations.

Should have some input. Not every teacher should do their own thing. Also business should be involved. Teachers and NCTM, colleges should have some involvement.

Table B4 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact should mathematics teachers have on determining the basic content that is taught in their mathematics courses?"

San Diego

> We change things. We are trying to develop our own. We are talking about interdisciplinary units.
>
> That's hard to answer. I've seen it go one way too far and vice versa. It can vary, based on collaboration with others.
>
> We should have an impact, but we shouldn't be the only ones to have an impact.
>
> I think teachers who attend conferences should have the opportunity to use those things they . . .

San Francisco

> They should have an active role in developing the content. There should be collaboration at the site to develop the school's curriculum based on research and including textbook selection and so on.
>
> A fair amount. They have it. They are given a curriculum and a book, but they have freedom to stress what they think is important. They should consult more in textbook selection and curriculum.
>
> If we take the time to decide what content should be, it's a commitment we're not paid for. What impact we should have and do have are different. I think we could have more impact if we had more time.
>
> The content of their own courses, or of math courses in general? The way it is now teachers can do anything they want, because they're isolated and they can just close the door and nobody will know what's going on--good or bad. Hopefully, good teachers can share their ideas and have an impact on what goes on in other classrooms. I think teachers should determine what they should teach for themselves, but they should be able to make informed choices, based on research and other teachers' experiences.
>
> Individual teachers have their own individual styles and I think they should choose what works best for them. They should be able to choose their own books, and, to a certain extent, what to teach. Of course, that doesn't mean if they are supposed to teach algebra they should be able to teach . . . whatever. They should know what they are doing.

Table B4 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact should mathematics teachers have on determining the basic content that is taught in their mathematics courses?"

St. Louis

Teachers should be the leaders rather than followers.

Equivalent to the language arts department in time allotted, funds, and remedial assistance.

Selection of curriculum to be used as well as goal and objectives to be taught. Decisions and input on materials, activities, and planning of basic content.

That would be determined by the amount of knowledge that the teachers had concerning skills that the business world is looking for.

Teachers should be the main portion for any group determining the content. Those not directly involved in the classroom activities should play a minimal part.

80% impact.

Twin Cities

I think they should definitely have a strong say. They are the people who see what works and what doesn't. However, there are groups that must have outside influences.

Each teacher should not decide individually, but collectively math teachers should make the decision.

Teachers should make major decisions on content.

They should have a great deal of impact--but within certain guidelines agreed upon by the

Table B5. *Teachers' Responses to the Diary of Professional Relationships*

"What impact do teachers in your school have?"

Cleveland

I have a great deal of impact now because I can choose the material that I want to cover. I follow the objectives to a certain extent, but we have great latitude in choosing lessons.

We have an impact and are able to prepare students for applications in mathematics.

None. Example: Our expanded teacher is used for attendance drive, tardy desk, social functions, and computer science. She teaches only one class of Pre-Algebra. She tutors on an irregular basis. All of her duties are assigned by the principal. The expanded teacher is at the mercy of the principal. She is treated differently from the rest of the teachers.

Teachers construct tests and write bellwork to attempt to correct an identified problem.

We have a very autonomous group in terms of how instruction is performed. Books purchased systemwide limits our ability. We should have time to choose textbooks for our school, independent of school system adoptions.

Durham

We have little impact on deciding course curriculum, the state decides what we must teach through the use of end-of-course tests. My particular school gives us all of the leeway possible under the conditions imposed by the state.

Less than we could because of the dependence on the text. We have a fair amount of freedom, but some do not take advantage of it.

Next to none. We have been given the states objectives to follow and are not encouraged to vary them.

We make an effort, some of it successful. We do make sure that courses that are needed are taught but we are constrained by the state requirements and testing program.

We meet, discuss, decide. Subject areas coordinate content. We have a lead teacher in each subject, the older more experienced teachers help the new teachers. We have a fair amount of decision making within the department but not too much as individuals.

They have a big impact because they are encouraged to provide enrichment activities that go beyond the book. New teachers have trouble because they don't know what students need beyond the text. It is difficult for new teachers to follow the advice of professors or education theorists because their suggestions are often impractical.

Table B5 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact do teachers in your school have?"

Los Angeles

Unfortunately, too much because they don't follow guidelines to nurture and protect students. This can lead to the students' detriment.

Great amount. We teach without texts so we make up content.

None. I should say some, they talk about where they should be in the book.

No-one monitors what teachers do so they can do what they want. Textbooks dictate. It also depends on teachers to teach what they want, others are guided by what the textbook companies write.

We have about 70% control.

Memphis

I have had a lot of impact on my classes because I have ventured out and tried some new things. As a general rule the Board of Education provides curriculum guides and math supervisors expect us to follow them.

The teachers in my school must follow the curriculum set by the Board of Education. They have no impact so far.

None, we must follow the MCS curriculum. In fact, supervisors want us all to be at the same place at the same time regardless of the individual students we have in the classroom.

In my school, teachers have some input into the content presentation but all must follow the curriculum of the school system.

They must follow the curriculum set by the MCS. They can decide how a topic is presented.

Philadelphia

Probably more than most schools. We have a very strong, articulate department and our principal, a former math teacher, is very supportive.

They all use school district determined curricular guides, but deviate from them as required.

Some impact--a few serve on curriculum committees.

Our department head will listen and sometimes implement teacher ideas.

Very little.

Table B5 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact do teachers in your school have?"

Philadelphia

40-50%.

None.

On instruction, large; on content, small except as reflected in the peripheral areas of investigation pursued by staff.

They have a great deal of leeway in the material presented and technique used.

Pittsburgh

More impact than ever. About 75 or 80%. Board has the final decision. Some participate in developing new problem-solving committee.

Now we have about that. Teachers are involved in the curriculum.

Any teacher could have been in pilot courses.

Involvement in pilots, presently geometry, elementary functions.

Curricular committee involved. Geometry pilot your own book. Inserviced other teachers in the district.

San Diego

Not as much as my previous school. We are just beginning to move in that area.

A lot of us were on the textbook committee. We made an impact.

Pretty great. We know AGP guidelines, what we are supposed to cover. We have a lot of flexibility in what we are to cover.

In curriculum writing, 10 people are working on a demonstration project, 2 people are working on district writing.

Table B5 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact do teachers in your school have?"

San Francisco

I do math inservice at our school. I've done over 50 workshops over 15 years (34 in one year). Everybody goes to hands-on, problem-solving, portfolio type lessons. Teachers are using diens blocks, pattern blocks. We've used "Math Their Way" curriculum, too.

It's real individual. It varies from teacher to teacher. Some go page by page through a book and some use innovative new ideas.

We're assigned a book and then we choose what to teach from what's in the book. Actually, we can do what we want, but the book sort of defines the curriculum. It's easier to follow the book.

I think we have a great impact on the content of our courses. We choose our books and we choose what and how to teach out of them. But we abdicate much of the responsibility for the course content by just following the book. Then the book determines the content.

Most teachers don't have that much impact. More books are being adopted on a district level now, and most teachers just go through the book.

St. Louis

We are willing to try new methods; currently all the math teachers are involved in pilot programs.

Behind language arts and reading, vocal music, and then math. We have two remedial reading teachers but only one remedial math teacher. Entire student body comes to a "Writing Enrichment Lab and Science Lab"--no math lab for all to "explore" many wonders or to extend their understanding past the so called "regular" classroom.

Teachers make daily, weekly, and quarterly lesson plans, also use of materials.

None. I am the only math teacher who has attended any math workshops, conferences, or conventions.

They relay requests, comments, suggestions to a curriculum committee through their department head. Representatives are appointed to selection committees.

10%.

Table B5 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What impact do teachers in your school have?"

Twin Cities

I feel we have a great deal of impact; we have revamped our math department and other departments are working with us. Student achievement has also improved.

We are part of that collective decision making body city wide.

We decide nearly everything. Some courses have general outline.

We have a great deal of impact. We have books that have been issued--and it is our choice of sequence and emphasis.

I can change the curriculum if I follow the learner outcomes.

Table B6. *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics teachers play in the evaluation of mathematics teachers?"

Cleveland

It is better if a math teacher does the evaluating rather someone who has never taught math. The math teachers should do the evaluation.

One in the same department would be the best, but it is necessary to evaluate each other. You can learn from others through sharing of teaching. It should be more sharing and less evaluation.

Since experienced teachers have experience, they should evaluate the new teachers.

Supportive. Offer an alternative method of presentation of an idea.

Peer review is an excellent concept, but not the way it is done in this system. The selection of the reviewer is dangerous.

Durham

They should be able and willing to help each other with any weaknesses that they may have to deal with. Not a hyper-critical role but a role of providing constructive criticism. We all need help from time to time and where better get it than from each other.

Teachers should be the primary evaluators.

Who is better able to evaluate a mathematics teacher than another mathematics teacher? We should have a great deal of input in evaluation instruments and be part of the evaluation team.

They should interact with constructive criticism with other mathematics teachers. I have a problem with being responsible for the evaluation of other mathematics teachers when it comes to differentiated pay scales.

Much more than they do. Mathematics teachers should be the ones to use the evaluation instrument provided by the state when evaluating other mathematics teachers. The mentors, peers and others who act as coaches to beginning teachers should have a large voice in their evaluation.

They should play a vital role because they are familiar with the content and presentation of the material. It would also serve as a way to share ideas among mathematics teachers.

Los Angeles

Everything. Teachers are the best to determine and evaluate content, effectiveness, and they are able to see good techniques, due to the fact they practice the techniques and know the content.

Table B6 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics teachers play in the evaluation of mathematics teachers?"

Los Angeles

Much greater--we should evaluate and hire each other.

I don't believe math teachers can objectively study another math teacher. In their mind, they would think how you would give that lesson better or in a different way.

We need to move toward pure evaluation. All department members would be expected to be involved. You get more cohesion.

100%. They should definitely evaluate each other.

Memphis

Department chairman should play a role in evaluating math teachers. Their professional opinions should be heavily considered by principals. However, department chairmen should be carefully chosen, paid extra, and given an extra planning period.

Teachers should play a mentoring role and work together in team-teaching situations. I do not feel that teachers should evaluate other teachers.

Math teachers should evaluate other math teachers, especially if they are trying to earn Career Ladder credit. It is absurd to have non-math teachers observe and evaluate math teachers when they do not know the content or how it should be approached. In fact, supervisors have been out of the classroom so long or have never taught upper division math courses that it's difficult for them to judge math teachers as well other math teachers could do.

I think math teachers should evaluate other math teachers if it is an advisory role. A collegial type of evaluation would be good if it is in agreement with both parties. I think teachers evaluating other teachers should be for improving instruction and not for focusing on deficiencies. It should not be used for promotions.

This is a tough question. I think math teachers are more knowledgeable about what should be taught. In Career Ladder evaluations, math teachers are often evaluated by PE, vo-tech, and other teachers. They do not know the best way to present a math concept. Also, teachers are more in tune with the latest trends than many supervisors or principals. I do worry about morale among peers evaluating others.

Table B6 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics teachers play in the evaluation of mathematics teachers?"

Philadelphia

A very diplomatic, professional one. Help rather than criticism.

None.

Observing their colleagues would be most helpful but not to evaluate each other.

None. This is an administrative function.

Teachers should not evaluate teachers but rather offer support systems for improving methods, etc.

75%.

Some. It is problematic. There should be some togetherness.

Large. Ownership of evaluation is essential if teachers are to assume responsibility for their own performance and professional growth.

This role should be minimal and only assigned to qualified individuals with math teaching experience.

Pittsburgh

60%. Important to have other ideas as well because they are using math as well.

Should not have a role. Really, a role of administrator.

Here department head (ITL) observes a couple a month. Five teachers know what happens in other classes. Will sit in on each other! Constructive when head sits in.

ITLs should not rate , but be as support. Principal doesn't understand math. Supervisor (or in combination) [Currently principals]

Not the sole evaluator because not trained to evaluate. Some teachers are changed.

San Diego

Good math teachers should evaluate math teachers.

Teachers should assume some responsibility. A principal in that discipline will do a better job than in other areas.

Table B6 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics teachers play in the evaluation of mathematics teachers?"

San Diego

> That is a harder question. We would rather pass the buck. Undecided.
>
> I'm not real clear on that. I think informally, in a helpful sharing way. I'm not sure I like teachers evaluating other teachers.

San Francisco

> They should be equals in a collaborative process. They should work with and support each other--offer positive feedback. More a supportive role than evaluative.
>
> They're in a good position to evaluate math teachers--better than non-math teachers. But we don't--it's a touchy subject. I can think of teachers that I wouldn't want to evaluate me.
>
> The collaborative could have a role as an experiment. They could fund substitute time for a building. Teachers could visit each other and get ideas. Not for evaluation. We're isolated. We could have meetings and talk about ideas. Evaluation could grow out of that, but it should start with sharing, like the cross-grades visits, but within a school.
>
> They should have a chance to observe each other and give feedback. As far as evaluation goes, like for tenure, I don't know. That puts the teachers in an uncomfortable position. I guess maybe a teacher should be able to ask for an evaluation by his peers if he's unhappy with a principal's evaluation.
>
> We should all be given time to observe each other so we can learn from each other. I don't know about evaluation.

St. Louis

> We should "police" ourselves.
>
> None. One should assist by observing and then professionally suggesting changes to enhance one's performance.
>
> Evaluation and improvement of instruction and professional program.
>
> Sounds like a good idea, but is it feasible?
>
> None.
>
> I think math teachers can come in, see lesson only to help teacher improve lessons. Also to demonstrate, not to evaluate.

Table B6 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role should mathematics teachers play in the evaluation of mathematics teachers?"

Twin Cities

(No response)

They should have equal or greater say than administrators.

Math teachers and all other departments should have time to observe other teachers, hold evaluation discussion and exchange ideas. Mentors and official evaluators should be trained.

I believe that some of the evaluation should be done by math teachers. Administrators should also be involved.

Teachers are the best evaluators.

Table B7. *Teachers' Responses to the Diary of Professional Relationships*

"What role do the mathematics teachers in your school play in regard to the evaluation of other mathematics teachers?"

Cleveland

None.

None. We do share ideas, etc.

None.

Some (50%) share alternative methods.

Not much. Only in informal talks.

Durham

The members of our math department have good rapport with one another. We share ideas and materials with one another. We do not criticize, but we do encourage, especially first year teachers.

Next to none. The evaluation system is not geared toward content evaluation nor to effectiveness.

None. We complain vigorously about the state evaluation instrument to no avail.

The department chair contributes to the evaluation instrument and the mentor acts as a conduit for help and information to new (3 years or less) teachers.

The chairperson visits and helps other teachers as does the mentor for new teachers. We have a subtle and indirect voice in the evaluation. Our principal seeks our input but now because he must.

New teachers are given mentors. These mentors are usually more experienced mathematics teachers who observe the new teacher, provide feedback to the new teacher and also evaluate them.

Los Angeles

Zero. However we do encourage trying new things.

None.

Table B7 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do the mathematics teachers in your school play in regard to the evaluation of other mathematics teachers?"

Los Angeles

None.

No say so.

About 25%, the department chair.

Memphis

None.

In my school, teachers play no role in the evaluation of other teachers.

None.

At my school, we are encouraged verbally to work together.

None.

Philadelphia

We try to be supportive. Some teachers have such poor backgrounds in math, or have lazy teaching methods, that very little can be done (we try tutoring the students).

None.

None.

Our department head is the rating "official designee" for the principal.

None.

0%.

None.

Small. None of their evaluative efforts are formalized. Most are rumor and hearsay or based on conversations with the person being judged.

None.

Table B7 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do the mathematics teachers in your school play in regard to the evaluation of other mathematics teachers?"

Pittsburgh

Not much at all. The department chair and vice-principal do now, and the supervisor (math, once or twice a year.)

No role. ITL observes. If problem, administrator role.

Here department head observes a couple times a month. Five teachers know what happens in other classes. Will not butt in on each others! Constructive when head sits in. (Teacher gave this response to both questions 3a and b.)

None.

[One teacher] observers classes, then gives feedback.

San Diego

None.

Very little as far as evaluation. Principal and vice-principal do the evaluation.

In our department, our chair may offer suggestions on what's going on in the classroom, but nothing formal.

None.

San Francisco

None. I wish we had release time to have an opportunity to observe each other .

None.

None.

We have all had a chance to observe each other and talk about what we do.

None.

Table B7 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What role do the mathematics teachers in your school play in regard to the evaluation of other mathematics teachers?"

St. Louis

None.

None openly; few take opinions and/or observations to key personnel.

Assistance, workshops, sharing, supporting, and encouraging.

None! The math teachers at our school don't have any common planning times. Each math teacher is essentially an isolated entity.

None. The department head visits but is not charged with making an evaluation.

Very little; the department head only can evaluate.

Twin Cities

(No response)

Several administrators are former math teachers and consequently well trained in math issues; however, the evaluations are done strictly by administrators.

None at present.

None.

I am alone in my building, but I have developed a support system of other math teachers through TCUMC that allows me to get constructive criticism.

Table B8. *Teachers' Responses to the Diary of Professional Relationships*

"Do you think of yourself primarily as a teacher or as a mathematician? Why?"

Cleveland

More as a teacher. I spend much more time on showing how to do the concepts of mathematics.

Teacher. I am concerned that students learn and not how much I know.

A teacher. I communicate existing knowledge to others.

Teacher. I do more than just teach math concepts.

Sixty percent teacher, 40 percent mathematician. The mathematics that we teach is only a portion of the whole world of mathematics; therefore the teacher has to come first.

Durham

As a teacher. The math that I teach each day is so fundamental that teaching these concepts becomes the goal. The math I took in college is seldom used.

A teacher--I know some mathematicians and they are not like me. To me, content is not the end, it is the means.

I think of myself as a teacher more than as a mathematician mainly because I do not have the opportunity to explore mathematics with my students. I would like to have the chance to DO math and then share it with my students.

I am comfortable with mathematics, but I consider myself as a teacher first. I feel that in the classroom I do more than teach skills in the field but also teach life skills which my students need desperately.

As a teacher, because my career is teaching oriented. I work with students and do the same math over and over, rather than engage in serious research as a mathematician does.

I am as much one as the other. I have a great appreciation of and fascination with math but I also love explaining and teaching math. I love being with people; I appreciate math for how it enriches people's lives.

Los Angeles

Teacher. My primary objective is to impart a sense of math instead of practicing math myself. I get a joy out of it.

Teacher first. [It's a] philosophical thing for me. Knowledge of subject area important. We have to be there as a teacher for our students. Teaching is a calling.

Table B8 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Do you think of yourself primarily as a teacher or as a mathematician? Why?"

Los Angeles

Mathematician because I understand nature's intertwining of math and life. I have the foresight to be able to facilitate the learning of math for students [which] is secondary to my math skills. I understand math in life. It's an exact science with formulas. You can go to the moon with math. I backed into math teaching. I've worked with math in the real world.

More as a teacher because you have to train kids on to math. A mathematician works in the real world. A teacher has to get kids interested in education and [have] a whole person concept of kids.

Teacher, because I take a holistic approach to math. I use math as a problem-solving tool.

Memphis

I think of myself as both. My job is to teach my students so I must consider where they are and what their needs are and teach accordingly. But I also enjoy just doing mathematics and trying to understand why everything works the way it does.

Mathematician. My first love is mathematics. I have thought of giving up teaching but I have never thought of giving up mathematics.

Teacher. My children are important to me. I teach them a little of everything about life. They tell me everything; I am a second mom to many of them.

Teacher. I face a class of students every day; a mathematician couldn't do that.

Teacher. I enjoy the thrill of working math problems and the beauty of how math concepts intertwine. However, I enjoy the interaction with students more. I think I would get tired of working alone with math concepts for six hours a day for over fifteen years. Yet, I am not tired of teaching after the same length of time.

Philadelphia

I'm a teacher. Who can explain instinct?

Teacher. Mathematician implies to me the constant use of higher-level skills than those needed to present my subject area material.

Teacher. Due to the ever-increasing technology sector and being that it has a major impact on the mathematics field, I do not feel that I am a "mathematician."

Teacher/instruction of a curriculum. I think mathematicians concern themselves with research at a higher level.

Table B8 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Do you think of yourself primarily as a teacher or as a mathematician? Why?"

Philadelphia

Teacher.

Teacher. I have a B.S. in math, but I have teaching skills which can be easily transferred to other areas where I am knowledgeable.

Teacher. The transfer of knowledge rather than the use of mathematics.

Teacher. I'm mostly concerned with the growth of the student and mathematics is the focus of my dialog with him/her. Five years of elementary teaching (1st grade) brought this attitude to my approach.

Teacher. While math is my first love the growth of the students assigned to me is my first interest.

Pittsburgh

Combination of both because doing both.

Teacher. Do more than teach math. Leads to everyday part of life. Only sources of discipline seen during day.

Teacher. Spend more time on organizing kids, showing them how to manage time, etc. than doing math (Grade 9). In trigonometry, straight math. In herself, a teacher is more important dealing with kids.

Teacher, because feels a mathematician operates on a higher level (in the sense of what is taught--content). First year, able to say to General Math "not just math."

Teacher: I take knowledge and transmit it to someone else.

San Diego

Both. Teaching is different.

Sometimes both. In some courses like general math, I'd say teacher. In advanced classes, I'd say mathematician.

Teacher. I see a mathematician as doing research and I see myself as passing on information in a creative way.

A teacher. I taught for 14 years. Math is my minor and I have taught math for 5 years. My stronger role is teaching children rather than math.

Table B8 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Do you think of yourself primarily as a teacher or as a mathematician? Why?"

San Francisco

More as a teacher. Math is my avocation. As an elementary teacher, I do all the curriculum, but math is my first love.

A teacher. As elementary teachers, we teach everything.

A teacher. I don't really do math; I just teach it. How do ordinary people do math? I just do arithmetic--consumer math. My major job is to get information across but not really do it. Maybe we should see ourselves as mathematicians. Maybe if we could see ourselves as mathematicians and get the kids to think of themselves that way maybe we wouldn't lose so many people--teachers and students.

A teacher. I don't ever really break any new ground. I learn new things and use math to figure out things I didn't know before, but nothing like a university researcher.

A teacher, I guess. Actually, I want to be a facilitator for my students to do mathematics--helping my students be mathematicians, though not in the sense of a professional mathematician: someone who does math for a living.

St. Louis

Teacher because I am interested in student learning rather than researching pure math.

As a teacher. Must be forever "operative" of the whole picture--the learning process itself; regardless of the situation (subject taught); must guide and direct observations and findings to a logical conclusion.

Both teacher/expert and learner. We teach as experts in math. As an expert we are mathematicians.

I teach other subjects in addition to teaching math. As a middle school teacher, I have many duties and obligations that have nothing to do with mathematics instruction.

A teacher of mathematics. A mathematician is active in exploration and pursues the proof of new theorems and promotes the use of them.

Teacher. I did not major in mathematics or minor. My masters was mainly in elementary math, with a few courses in high school math.

Table B8 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"Do you think of yourself primarily as a teacher or as a mathematician? Why?"

Twin Cities

(No response)

Teacher. "Mathematician" works with numbers all day--I work with students.

Teacher--there is little time to do anything else (especially with family).

I have a difficult time answering this question. I guess I consider the answer a tie! I work mostly in teaching children, but I do spend spare time reading--and doing--mathematics.

I am a teacher first; that is what I have always wanted to be.

Table B9. *Teachers' Responses to the Diary of Professional Relationships*

"What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?"

Cleveland

Mathematics is essential to the preservation of society. Without mathematics, the inventions and discoveries made in history would have been impossible. Without mathematics, new discoveries would be impossible.

We teach processes of logical thinking needed for problem-solving.

Discipline, organization and regimentation. A math teacher can relate much better to money matters than any other.

We provide students with a way of measuring the world around them quantitatively so that decisions can be justified. Also we provide problem-solving techniques that our students will apply in future experiences.

We set a nationwide standard as a goal and this is unique among the subjects in schools.

Durham

The word "mathematics" scares so many people that I hope that we as math teachers can help overcome this fear and allow students to see how much fun math can be.

We teach students to work with what they have got within the confines of an axiomatic system as much as we have to do in life.

Math helps to build mental muscle. We can give students the ability to think logically, which is always useful in any endeavour.

We have a greater impact on career choices. We make the students aware of the role of economics in his life. We lead the student to a higher form of logical thought.

We offer more exactness. Mathematics offers a concrete way of problem solving. We stress logic and thinking skills. We emphasize how to organize known facts and find the unknown from them.

Math teachers prepare students to solve problems in their everyday lives and provide them with a way to make their lives easier. They also give students the tools necessary to care for themselves and their families (balance check books, budget $s, stocks, read charts, understand statistics, interest, measurement, how to find the best buy at the store, how to file taxes, appreciation of nature, computer tech, etc.)

Table B9 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?"

Los Angeles

Math teachers promote better consumers. We can practice that in math education. I believe math teachers have the opportunity to promote critical thinking based on true data, i.e., newspapers to summarize other subjects, promote a lot more fantasy, and past facts in developing thinking.

We're teaching future scientists. Teaching bilingual math is the only course where lack of English won't hurt content. Almost a language-free environment. Spanish kids only learning in these courses.

A person [who] can't speak English can survive but you can't survive in today's world unless you are able to work with numbers. We are a money/number society. All our existence is number-oriented. Teachers help students understand numbers and use calculators. We put them out with priority life skills; math is priority.

None. I never thought of us as making a contribution.

We are the social pragmatists. Teaching problem-solving as part of our daily life.

Memphis

Mathematics teachers train their students to think through things. We can give them real-world problems that are faced by people. Statistics fits well into this world.

I feel that practically all fields are touched by mathematics. This is how we contribute to society in a way different from other teachers or other professionals. All careers need math to some extent.

Math teachers address more logical thinking. We prepare students for the technological needs of society.

Math teachers contribute to a student's development of reasoning skills. In fact, mathematics stresses more use of the higher mental skills such as application, synthesis, and analysis. Logic is emphasized.

Math teachers are the basis for our nation's hope to improve in the technological race with other nations. We teach the foundations needed in many fields. The nation would have no hope of competing in science, engineering, and physics without good math teachers in the field.

Table B9 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?

Philadelphia

Math pushes society into the future!

They provide the most necessary of fundamental life skills, being about to calculate, reason, and think logically.

Getting across the importance of mathematics in our every day life.

We give students reasoning techniques built upon quantitative skills that the other disciplines do not.

The preparation of a mathematically literate population. Motivation to pursue careers in math.

I don't know how they differ from other teachers, but they differ from other professionals in that they have profound and lasting impact on the future, through their charges.

I don't know.

They provide the clearest models for replacing complex situations with symbolic statements which can be manipulated to arrive at probable generalizations about those situations. Real "problem solving" is, perhaps, most clearly illustrated in the classrooms if they [teachers] are good.

They help to give order and precision to the way we live. They give the ability to develop logical thinking and an ordered thought and approach to problems.

Pittsburgh

Students learn how to discipline themselves, think more logically, and use their knowledge to analyze life.

Math teachers not only instruct students to solve problems, but also [to] relate to real-world problems and applications.

Teaching both a skill and logic (how to think rather than just processing information). Others don't recognize how hard it is to teach kids to be responsible.

The only teachers who expect students to have self-discipline, learn to think through things.

Math is important to society. Everyone needs some math. We serve society.

Table B9 (continued). *Responses to the Diary of Professional Relationships*

"What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?"

San Diego

Mathematics teachers impact every area of life.

Look at math itself, there's not a day goes by that math is not used. Whether we look at it as math or not, it is used. . . . Solving problems etc.

Math is the foundation of many disciplines, science, etc. It's a very special role. We're in the same position as reading teachers.

I have a hard time separating this [from my] art. Math ties together the chaos in the world.

San Francisco

I'm not sure if they do. Good ones instill a love of math. It's easy to do fun things in math, but all teachers contribute equally.

Math is very basic. It affects the way people think. Math teachers can affect how students think critically--how they make sense out of the world.

Some of them do a lot of stuff. All I can think of is it's the only class where we teach math ideas.

They contribute to making a more math-literate society. We're responsible for helping students understand ways things are quantified--skills like interpreting graphs, or skills needed in science. On the downside, I have a feeling we contribute disproportionally to the drop-out rate. Our students' failure in math can be a first step toward failure in school.

A math teacher can help people see how math is related to other aspects of their lives--where it appears in architecture, or nature, or art. We also teach reasoning in a sort of different way than other subjects.

St. Louis

We are responsible for all aspects of society, i.e., aircraft designing, electrical engineering.

Assist learner in seeing the spatial, quantitative relationship in his/her environment and verbalizing the explanations, orally and written. Take the written quantitative expression of another and see through the "conversation" between writer and student and draw a conclusion.

Provide society with individuals equipped with knowledge and skills to solve problems specifically in a scientific and technological area, also problem solvers and critical thinkers in life.

Table B9 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"What unique contributions to society are made by mathematics teachers that are different from the contributions made by other professionals, including teachers of other subjects?"

St. Louis

Logic. Order.

The mathematics teachers focus towards skills to be used immediately on the job and for use in college. This application is easily tested and constantly evaluated in this area more than many others.

Not sure.

Twin Cities

(No response)

Math teachers bring the world of mathematics to kids or students of any age.

Teaching: Problem-solving as a real life skill.
Use of technology is important and math skills are usually required.

The subject matter itself is rigorous and it takes effort to earn the math degree. The thinking skills do carry over into other subjects and to life skills as well. In an increasingly technology-based society, the role of mathematics teacher becomes even more important as we prepare children to live in the 21st century.

We can get the students to view problems from another angle, another perspective. The beginning of logic . . .

Table B10. *Teachers' Responses to the Diary of Professional Relationships*

"How has the collaborative enhanced your view of yourself as a professional?"

Cleveland

It's made me feel more important in that mathematics is essential to the growth of our society.

It makes you feel good about yourself and [you] can share ideas and realize that what happens to you, both positively and negatively, also happens to everyone else.

By giving us some respect and recognition. And helping us in learning new ideas.

The chance to see that efforts I make to teach basics are being used and applied.

My self-esteem has been enhanced because of the professional treatment I received. I consider the things that we do together making us, as a group, better prepared for our students.

Durham

It has basically improved my morale and helped me see myself as an important person not only to my students and to myself but also to the community.

Made me appreciate the larger fraternity (beyond my school) to which I belong, much the same way a sales meeting pumps up the sales force. It's hard to maintain the view of yourself as a professional when it's just you and 110 kids day after day.

I have not been in the area long enough to have gotten a major effect from the collaborative, but I have found it to be refreshing and inspiring as well as confidence building.

DMC has treated me as a professional. It makes an effort to ask me how I feel and seeks out my opinions. It not only allows but encourages teachers to be part of the decision-making process. It has greatly enhanced my self-worth as a teacher and as a person.

It has made me feel good. I have been treated as a professional. It has offered me opportunities to attend workshops. Through the receptions, etc., I have met leaders in my field. I feel that I am an important person and that my ideas are important, that my attendance is valued. It is wonderful, the best thing that has ever happened to the mathematics teachers of the area.

It has given me an opportunity to attend conferences and further my education. It has made me aware of other math teachers and how to excel in my profession.

Table B10 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"How has the collaborative enhanced your view of yourself as a professional?"

Los Angeles

I have concrete resources to go to for evaluation and feedback. When I am approaching a new goal I have support from other teachers. The collaborative exposed me to a greater variety of teaching strategies. Through proposal writing I learned about using other sources for funding like industrial and political. I have been encouraged to explore alternatives. A means to focus on things being tried in math that, if left to my own, I would never have been exposed to.

A lot. I can go to professional meetings and see people I know. I can call for help. I'm aware of the direction of math in the country. It makes me more professional.

It solidified my knowledge that I am a top math teacher. All teachers use me as a resource. My expertise is never lost. [It] gave me a self-assured feeling.

I am more certain there is a profession of teaching. The collaborative establishes it as a profession not just a job. I never realized that until my department got involved with +PLUS+.

Wider base of comparison of other teachers [at the] state and national level. Greater network, more information faster of what's current in the field. More importantly, what's working and what's not.

Memphis

The collaborative has helped my professionalism. It is doing what a mathematics organization should be doing. I feel that I am qualified to decide what and how my students should be taught. I'm not so different from the many other mathematics teachers around the country.

MUMC has raised my consciousness of the potential impact that math teachers have on the world. Thus, it has given a higher status to my job and my opinion of my profession.

MUMC has given me an opportunity to be with professional people, great mathematicians, and others who take math seriously. I have grown professionally because of MUMC. It has helped me to expand my instructional strategies, be creative, and to understand students better.

MUMC has made me feel more professional by just being there. Other professionals have professional organizations; e.g., AMA, Bar Association, etc. MUMC is really accessible and helpful. It has offered workshops that are geared to updating professionals. It has been a big help and I appreciate it.

The collaborative has helped me to feel good about my profession and its importance. It has offered workshops to help me learn new concepts, new teaching methods and creativity. I have met many math teachers with whom I feel comfortable sharing ideas and methods. I feel good about sharing/helping others.

Table B10 (continued). *Teachers' Responses to the Diary of Professional Relationships*

How has the collaborative enhanced your view of yourself as a professional?"

Philadelphia

It has forced the community (educational and business) to view the teacher as an important professional. I'm proud to be one.

It has provided me with a vehicle for expressing my opinions and views in a public forum. It has also given me access to new ideas and trends which are very important to a professional in any field.

It has increased my "professionalism" and allowed me the flexibility to treat the teachers in my department and on my curriculum committee to refreshments and make them feel important.

Until another teacher handed me this form, I had no idea we were a member of a collaborative.

(No response)

I haven't been very involved the last two years.

Not at all.

Not to a large extent. I've been very active for the last 22 years and the collaborative is another support system that I am presently using as I pursue my goals for self, students, and society. God, that sounds highfalutin!

It has given me the opportunity to interact with other math educators in a professional manner. It has given us a voice that can be used to express the opinion of math teachers as a group.

Pittsburgh

General knowledge. Being able to meet other professional people and getting ideas.

Made me a better professional. Allowed me to do things not able to [otherwise].

Some things are social, nice being around math teachers. Has benefitted by meeting other teachers, giving information, strategies, courses, what is available.
Was the school rep: time was difficult. Hard for teachers to have energy after.

Opportunity to go to lectures, deal with other people throughout the system; not be so isolated. Also, feel [there is] more to math, not just arithmetic. Collaborative--the vehicle through ITL meetings citywide, plan inservice. Consequently can follow up back at school as worthwhile, self-development.

Table B10 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"How has the collaborative enhanced your view of yourself as a professional?"

Pittsburgh

Made me think about myself as a professional. Allowed [me] to meet with others.

San Diego

I have expanded to do other things [rather] than just stay in the classroom. I visit parents in the homes, I work with other teachers.

I don't know if I can say it enhanced it. When I think of enhancement, I think of adding on. I would say enrichment. It has offered even the retreat.

It's provided a way to recharge my batteries. It's better than going to the GSDMC conference once a year. . . . Seeing people regularly is good.

Not having math and then coming into the class, sharing has been helpful . . . dinners, etc.

San Francisco

It's inspired me, or should I say reinspired me, to do more. I did a lot years ago, then lessened my emphasis on math. The collaborative has inspired me to take an active role in education. I'm offering more math inservice at school. It's focused my consciousness on math. It takes time but it's given me credibility. I see more what's going on and I can tell teachers what I learned from a collaborative activity.

It has expanded my view of math education. As a primary teacher, I've dealt with primary issues. The collaborative has a broader view. I see how first grade lays the framework. I see math as much more open-ended now.

It's the only chance to meet other professionals. You see yourself as a professional because you see yourself as part of a group. The collaborative offers the only group experience. At faculty meetings, for example, we're just talked to. It's not an organization that makes you feel like a professional. We're in the role of students (in a faculty meeting).

It's made me more aware of what is going on in the field. It's broadened my experience from just being a teacher in a school to being part of a larger community of teachers from throughout the city and of other professionals. I know a lot more about math and math teaching, thanks to workshops and talks the collaborative has put on.

I was pretty involved in "professional" activities before the collaborative came along, so I can't say it made much difference. It has brought more people into the mix though.

Table B10 (continued). *Teachers' Responses to the Diary of Professional Relationships*

"How has the collaborative enhanced your view of yourself as a professional?"

St. Louis

The collaborative has offered additional training, information, and sharing with peers.

I'm not alone in my sufferings and that there is a support system to inspire, inform, and encourage professional growth. Meetings present chances to see a fuller picture of the "operations" in the field of math instruction. Gathering of funds to make ideas happen.

Self-evaluation and assessment of needs. Concern for continued professional growth toward the 21st century. To be constructive and productive in the class and the community.

Participating in various workshops and conferences has increased my knowledge and awareness of available resources and thereby has made me feel more confident and capable of solving more of my own problems. Also, my creativity has been awakened and revitalized.

Opportunity to see, hear, and evaluate programs and methods presented by others (local and non-local) has helped broaden my viewpoint, approach to teaching and methods. The chance to exchange ideas and methods with colleagues was helpful, reassuring, and stimulating.

The collaborative has had a lot of wonderful activities going on but this year I was not able to participate in many.

Twin Cities

(No response)

It has given me a more professional image of myself, a place of stature in the community, and a marvelous set of friends (equals) that I have no other contact with.

Even though I viewed myself as a professional, it was a very narrow perception. I did not see my professionalism as relating to, say, a lawyer. Now I see myself in a much broader view and do feel more belonging to the group of professionals as well as a responsibility to act as though I belong. I believe this involves leadership, reading journals, belonging to professional organizations . . .

I have found courage to become a leader both within my school and within the state network of organizations. I feel that I have a very serious and important job and I share this with my students. Also I continue to be excited about my job and all the change within the curriculum. I find myself too tired some of the time, but I am excited about all aspects of my job, the collaborative, and the changes.

I am treated with respect and dignity.